5922

BULLETIN
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME XXXVII, 1917

Smithsonian Ins
APR 1 6
National M

NEW YORK
PUBLISHED BY ORDER OF THE TRUSTEES
1917

(*Continued from 3d page of cover.*)

Vol. XIII. Anthropology (not yet completed).

**Jesup North Pacific Expedition, Vol. IX.*

Part I.— The Yukaghir and the Yukaghirized Tungus. By Waldemar Jochelson. Pp. 1–133, pll. i–vii, 1 map, 1910. Price, $3.40.

Vol. XIV. Anthropology.

**Jesup North Pacific Expedition, Vol. X.*

Part I.— Kwakiutl Texts. Second Series. By Franz Boas and George Hunt. Pp. 1–269. 1906. Price, $2.80.

Part II.— Haida Texts. By John R. Swanton. Pp. 271–802. 1908. Price, $5.40.

MEMOIRS.

New Series, Vol. I.

Part I.— Crania of Tyranosaurus and Allosaurus. By Henry Fairfield Osborn, pp. 1–30, pll. i–iv and text figures 1–27. 1912.

Part II.— Integument of the Iguanodont Dinosaur Trachodon. By Henry Fairfield Osborn. Pp. 31–54, pll. v–x, and text figures 1–13. 1912. Parts I and II are issued under one cover. Price, $2.00.

art III.— Craniometry of the Equidæ. By Henry Fairfield Osborn. Pp. 55–100, text figures 1–17. 1912. Price, 75 cents.

rt IV.— Orthogenetic and Other Variations in Muskoxen, with a Systematic Review of the Muskox Group, Recent and Extinct. By J. A. Allen. Pp. 103–226, pll. xi–xviii, text figures 1–45, 1913. Price, $2.50.

rt V.— The California Gray Whale (*Rhachianectes glaucus* Cope). By Roy C. Andrews. Pp. 229–287, pll. xix–xxvii, text figures 1–22. 1914. Price, $2.00.

rt VI.— The Sei Whale (*Balænoptera borealis* Lesson). By Roy C. Andrews and H. von. W. Schulte. Pp. 289–502, pll. xxvii–lvii, 1916. Price, $6.00.

ETHNOGRAPHICAL ALBUM.

Jesup North Pacific Expedition.

hnographical Album of the North Pacific Coasts of America and Asia. Part 1, pp. 1–5, pll. 1–28. August, 1900. Sold by subscription, price, $6.00.

BULLETIN.

The matter in the 'Bulletin' consists of about 24 to 36 articles per volume, which late about equally to Geology, Palæontology, Mammalogy, Ornithology, Entomology, and (in former volumes) Anthropology, except Vol. XI, which is restricted to a 'Catalogue of the Types and Figured Specimens in the Palæontological Collection of the Geological Department,' and Vols. XV, XVII, and XVIII, which relate wholly to Anthropology. Volme XXIII and the later volumes contain no anthropological matter, which is now issued parately as 'Anthropological Papers.'

lume I, 1881–86	Out of print
II, 1887–90	Price, $4.75
III, 1890–91	" 4.00
IV, 1892	" 4.00
V, 1893	" 4.00
VI, 1894	" 4.00
VII, 1895	" 4.00
VIII, 1896	" 4.00
IX, 1897	" 4.75
X, 1898	" 4.75
XI, 1898–1901	" 5.00
XII, 1899	" 4.00
XIII, 1900	" 4.00
XIV, 1901	" 4.00
XV, 1901–1907	" 5.00
XVI, 1902	" 5.00
XVII, Part I, 1902	" 1.50
" " II,	" .75
" " III, 1905	Out of print
" IV, 1905	Price, $ .75
" V, 1907	" 1.25
Volume XVIII, Part I, 1902	Price, $ 2.00
" " " II, 1904	" 1.50
" " " III, 1905	" .50
" " " IV, 1907	" 2.00
" XIX, 1903	" 6.00
" XX, 1904	" 5.00
" XXI, 1905	" 5.00
" XXII, 1906	" 6.00
" XXIII, 1907	" 9.00
" XXIV, 1908	" 6.00
" XXV, Part I, 1908	" 1.50
" " " II, 1915	" .50
" XXVI, 1909	" 6.00
" XXVII, 1910	" 5.00
" XXVIII, 1910	" 4.00
" XXIX, 1911	" 4.50
" XXX, 1911	" 4.00
" XXXI, 1912	" 4.00
" XXXII, 1913	" 5.50
" XXXIII, 1914	" 5.50
" XXXIV, 1915	" 5.50
" XXXV, 1916	" 6.50

ANTHROPOLOGICAL PAPERS.

Vols. I–XIX, 1908–1916.

AMERICAN MUSEUM JOURNAL.

Journal' is a popular record of the progress of the American Museum of Natural issued monthly, from October to May inclusive. Price, $1.50 a year. Volumes 1900–1916.

Anatomy of the Common squid. By Leonard Worcester Williams. Pp. 1–87, nd 16 text figures. 1909.

se Pottery of the Han Dynasty. By Berthold Laufer. Pp. 1–339, pl. i–lxxv, figures. 1909.

For sale at the Museum.

d by E. J. Brill, Leiden, Holland. Not on sale at the Museum. American chert, 151–155 West 25th Street, New York City.

BULLETIN
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME XXXVII, 1917

Smithsonian Institution
244417
National Museum.

NEW YORK
PUBLISHED BY ORDER OF THE TRUSTEES
1917

EDITED BY J. A. ALLEN.

.N7A38

AMERICAN MUSEUM OF NATURAL HISTORY.

Seventy-seventh Street and Central Park West, New York City.

Board of Trustees.

President.
HENRY FAIRFIELD OSBORN.

First Vice-President.
CLEVELAND H. DODGE.

Second Vice-President.
J. P. MORGAN.

Treasurer.
HENRY P. DAVISON.

Secretary.
ADRIAN ISELIN, Jr.

Ex-officio.
JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK.
WM. A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK.
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS.

Elective.
GEORGE F. BAKER.
FREDERICK F. BREWSTER.
R. FULTON CUTTING.
THOMAS DeWITT CUYLER.
JAMES DOUGLAS.
HENRY C. FRICK.
MADISON GRANT.
ARCHER M. HUNTINGTON.
WALTER B. JAMES.
A. D. JUILLIARD.
CHARLES LANIER.
OGDEN MILLS.
PERCY R. PYNE.
JOHN B. TREVOR.
FELIX M. WARBURG.
ARTHUR CURTISS JAMES.

Administrative Officers.

Director.
FREDERIC A. LUCAS.

Assistant-Secretary.
GEORGE H. SHERWOOD.

Assistant-Treasurer.
THE UNITED STATES TRUST COMPANY OF NEW YORK.

SCIENTIFIC STAFF.

FREDERIC A. LUCAS, Sc.D., Director.

GEOLOGY AND INVERTEBRATE PALÆONTOLOGY.

EDMUND OTIS HOVEY, Ph.D., Curator.
CHESTER A. REEDS, Ph.D., Assistant Curator.

MINERALOGY.

L. P. GRATACAP, A.M., Curator.
GEORGE F. KUNZ, Honorary Curator of Gems.

WOODS AND FORESTRY.

MARY CYNTHIA DICKERSON, B.S., Curator.
BARRINGTON MOORE, A.B., M.F., Associate Curator.

INVERTEBRATE ZOÖLOGY.

HENRY E. CRAMPTON, Ph.D., Curator.
ROY W. MINER, A.B., Associate Curator.
FRANK E. LUTZ, Ph.D., Associate Curator.
L. P. GRATACAP, A.M., Curator of Mollusca.
A. J. MUTCHLER, Assistant.
WILLARD G. VAN NAME, Ph.D., Assistant.
FRANK E. WATSON, B.S., Assistant.
W. M. WHEELER, Ph.D., Hon. Curator of Social Insects.
A. L. TREADWELL, Ph.D., Hon. Curator of Annulata.
CHARLES W. LENG, B.S., Hon. Curator of Coleoptera.

ICHTHYOLOGY AND HERPETOLOGY.

BASHFORD DEAN, Ph.D., Curator Emeritus.
JOHN T. NICHOLS, A.B., Assistant Curator of Recent Fishes.
MARY CYNTHIA DICKERSON, B.S., Associate Curator of Herpetology.

MAMMALOGY AND ORNITHOLOGY.

J. A. ALLEN, Ph.D., Curator.
FRANK M. CHAPMAN, Sc.D., Curator of Ornithology.
W. DEW. MILLER, Associate Curator of Ornithology.

Roy C. Andrews, A.M., Assistant Curator of Mammalogy.
H. E. Anthony, B.S., Assistant in Mammalogy.
Herbert Lang, Assistant in Mammalogy.
James P. Chapin, A.B., Assistant in Ornithology.
Leo E. Miller, Assistant in Ornithology.

VERTEBRATE PALÆONTOLOGY.

Henry Fairfield Osborn, LL.D., D.Sc., Curator Emeritus.
W. D. Matthew, Ph.D., Curator.
Walter Granger, Associate Curator of Mammals.
Barnum Brown, A.B., Associate Curator of Reptiles.
William K. Gregory, Ph.D., Associate in Palæontology.
Charles R. Eastman, Ph.D., Research Associate.

ANTHROPOLOGY.

Clark Wissler, Ph.D., Curator.
Pliny E. Goddard, Ph.D., Curator of Ethnology.
Robert H. Lowie, Ph.D., Associate Curator.
Herbert J. Spinden, Ph.D., Assistant Curator.
N. C. Nelson, M.L., Assistant Curator.
Charles W. Mead, Assistant Curator.
M. D. C. Crawford, Research Associate in Textiles.
George Bird Grinnell, Ph.D., Research Associate in Ethnology.
J. H. McGregor, Ph.D., Research Associate in Anthropology.
Louis R. Sullivan, A.M., Assistant in Physical Anthropology.
Leslie Spier, B.S., Assistant in Anthropology.

ANATOMY AND PHYSIOLOGY.

Ralph W. Tower, Ph.D., Curator.
Charles F. Herm, Assistant.
Alessandro Fabbri, Research Associate in Physiology.

PUBLIC HEALTH.

Charles-Edward A. Winslow, M.S., M.A., Curator.
T. G. Hull, Ph.D., Assistant.

PUBLIC EDUCATION.

George H. Sherwood, A.M., Curator.
G. Clyde Fisher, Ph.D., Associate Curator.
Ann E. Thomas, Ph.B., Assistant.

BOOKS AND PUBLICATIONS.

Ralph W. Tower, Ph.D., Curator.
Ida Richardson Hood, A.B., Assistant Librarian.

CONTENTS OF VOLUME XXXVII.

PAGE.
Title-page i
Officers and Trustees iii
Scientific Staff iv
Contents vii
Dates of Publication of Separata ix
List of Illustrations x
List of New Names of Genera, Subgenera, Species, and Subspecies xiv
Errata xviii

Art. I.— Insects of Florida. IV. Lepidoptera. By JOHN A. GROSSBECK. (Edited by FRANK E. WATSON) 1
II.— New Acarina. Part II.— Descriptions of New Species and Varieties from Iowa, Missouri, Illinois, Indiana, and Ohio. By H. E. EWING. (Plates I–IV.) 149
III.— Pre-Cambrian and Triassic Diabase in Eastern Pennsylvania. By ANNA I. JONAS. (Map) 173
IV.— New Fossil Rodents from Porto Rico, with additional notes on *Elasmodontomys obliquus* Anthony and *Heteropsomys insulans* Anthony. By H. E. ANTHONY. (Plate V.) 183
V.— Supplement to Preliminary List of the Coleoptera of the West Indies. By CHARLES W. LENG and ANDREW J. MUTCHLER. 191
VI.— Second Paper on Brazilian Muscoidea collected by Herbert H. Smith. By CHARLES H. T. TOWNSEND 221
VII.— New Species of Bees of the Genus *Andrena*, from Equatorial Africa, in the American Museum of Natural History. By HENRY L. VIERECK 235
VIII.— Contributions to our knowledge of the Bee Genus *Perdita* Smith. By HENRY L. VIERECK 241
IX.— The Classification of the Weaver-Birds. By James P. Chapin. (Plates VI–X, and ten text figures 243
X.— A complete Skeleton of the Horned Dinosaur *Monoclonius*, and description of a second skeleton showing Skin Impressions. By BARNUM BROWN. (Plates XI–XIX, and four text figures). 281
XI.— The Skeleton of *Diatryma*, a Gigantic Bird from the Lower Eocene of Wyoming. By W. D. MATTHEW and WALTER GRANGER. (Plates XX–XXXIII, and one text figure.) 307
XII.— Descriptions of New Birds from Santo Domingo and Remarks on others in the Brewster-Sanford Collection. By FRANK M. CHAPMAN 327
XIII.— A new Rabbit and a new Bat from Neotropical Regions. By H. E. ANTHONY. (Plate XXXIV.) 335
XIV.— Notes on West Indian Syntomidæ and Arctiidæ (Lepidoptera). By WM. T. M. FORBES. (Five text figures.) 339

PAGE.

XV.— Effect of Humidity on Pupal Duration and on Pupal Mortality of *Drosophila ampelophila* Loew. By ADOLPH ELWYN. (One text figure.) 347

XVI.— Criteria for the Determination of Species in the Sauropoda, with Description of a new Species of *Apatosaurus*. By CHARLES C. MOOK. (Two text figures.) 355

XVII.— The Skull of *Kogia breviceps* Blainv. By H. VON W. SCHULTE. (Plates XXXV–XLIII, and two text figures.) 361

XVIII.— The American Museum Congo Expedition Collection of Bats. By J. A. ALLEN, HERBERT LANG and JAMES P. CHAPIN. (Plates XLIV–LV, twenty-six text figures, and map.) 405

XIX.— Two new Fossil Bats from Porto Rico. By H. E. ANTHONY. (Plate LVI.) 565

XX.— A Paleocene Bat. By W. D. MATTHEW. (One text figure.) 569

XXI.— Absence of the Pollex in Perissodactyla. By WILLIAM DILLER MATTHEW 573

XXII.— Field Notes on *Molothrus bonariensis* and *M. badius*. By LEO E. MILLER 579

XXIII.— Reptile and Amphibian Collections from the North Carolina Mountains, with especial reference to Salamanders. By EMMETT R. DUNN. (Plates LVII–LXI, and seven text figures.) 593

XXIV.— Studies in West Indian Earwigs (Dermaptera). By JAMES A. G. REHN and MORGAN HEBARD. (Plates LXII, LXIII.) 635

XXV.— Fresh-water Fishes of the Congo Basin obtained by the American Museum Congo Expedition, 1909–1915. By JOHN TREADWELL NICHOLS and LUDLOW GRISCOM. With Field Notes by the Collectors, HERBERT LANG and JAMES P. CHAPIN. (Plates LXIV–LXXXIII, thirty-one text figures, and three maps.) 653

XXVI.— Dentition of *Hydrocyon* and its supposed Fossil Allies. By CHARLES R. EASTMAN. (Plates LXXXIV–LXXXVII, and three text figures.) 757

XXVII.— Fossil Fishes collected by the American Museum Congo Expedition. By L. HUSSAKOF. (Plate LXXXVIII, and seven text figures.) 761

XXVIII.— The Skeletal Characters of *Scutisorex* Thomas. By J. A. ALLEN, with Field Notes by H. LANG. (Plates LXXXIX–XCII, and eight text figures.) 769

XXIX.— A note on the Lumbar Vertebræ of *Scutisorex* Thomas. By H. VON W. SCHULTE 785

XXX.— The Systematic Status of some Batrachians from South America. By G. K. NOBLE. (Plates XCIII–XCVI, and seven text figures.) 793

XXXI.— The Fore and Hind Limbs of *Diplodocus*. By CHARLES C. MOOK. (Two text figures.) 815

XXXII.— Notes on Paleocene and Lower Eocene Mammal Horizons of Northern Mexico and Southern Colorado. By WALTER GRANGER. (Plates XCVII and XCVIII, and map.) 821

PAGE.

XXXIII.— The Dentition of *Nothodectes*. By W. D. MATTHEW. (Plates XCIX–CII.) 831

XXXIV.— A Revision of the Eocene Primates of the Genus *Notharctus*. By WALTER GRANGER and WILLIAM K. GREGORY. (Plates XCIII–CVII.) 841

XXXV.— A new Albatross from the West Coast of South America. By ROBERT CUSHMAN MURPHY. (One text figure.) 861

XXXVI.— A new Species of Trematode (*Cladorchis gigas*) parasitic in Elephants. By G. A. MACCALLUM. (Plates CVIII–CX, and one text figure.) 865

XXXVII.— Ichthyological Notes from a Cruise off Southwest Florida, with description of *Gobiesox yuma* sp. nov. By JOHN TREADWELL NICHOLS. (Plate CXI, and one text figure.) 873

DATES OF PUBLICATION OF SEPARATA.

The edition of separates is 300 copies, of which about 100 are mailed on the date of issue, and the others placed on sale in the Library.

Art.	I,	Jan.	2,	1917.	Art.	XX,	Sept.	7,	1917.
“	II,	“	27,	1917.	“	XXI,	“	7,	1917.
“	III,	“	27,	1917.	“	XXII,	“	7,	1917.
“	IV,	“	29,	1917.	“	XXIII,	Oct.	13,	1917.
“	V,	Feb.	13,	1917.	“	XXIV,	Sept.	29,	1917.
“	VI,	Mar.	24,	1917.	“	XXV,	Nov.	26,	1917.
“	VII,	April	3,	1917.	“	XXVI,	“	26,	1917.
“	VIII,	“	3,	1917.	“	XXVII,	“	26,	1917.
“	IX,	May	8,	1917.	“	XXVIII,	“	26,	1917.
“	X,	“	31,	1917.	“	XXIX,	“	26,	1917.
“	XI,	“	28,	1917.	“	XXX,	Dec.	5,	1917.
“	XII,	“	14,	1917.	“	XXXI,	“	5,	1917.
“	XIII,	“	28,	1917.	“	XXXII,	“	5,	1917.
“	XIV,	“	28,	1917.	“	XXXIII,	“	5,	1917.
“	XV,	“	28,	1917.	“	XXXIV,	“	5,	1917.
“	XVI,	“	31,	1917.	“	XXXV,	“	10,	1917.
“	XVII,	June	28,	1917.	“	XXXVI,	“	29,	1917.
“	XVIII,	Sept.	29,	1917.	“	XXXVII,	“	29,	1917.
“	XIX,	“	7,	1917.					

LIST OF ILLUSTRATIONS.

Plates.

I–IV.— New Acarina.
V.— Fossil Rodents from Porto Rico.
VI, VII.— Mouth markings in young Weaver-Finches.
VIII.— *Hyphantornis cucullatus abyssinicus* and *Sitagra tænioptera*, nests.
IX.— *Hyphanturgus ocularius* and *Pyromelane flammiceps*, nests.
X.— *Pachyphantes superciliosus* and *Uræginthus bengalus*, nests.
XI–XV.— *Monoclonius nasicornus* Brown, skeleton.
XVI–XIX.— *Monoclonius cutleri* Brown, skeleton and epidermis.
XX–XXXIII.— *Diatryma steini* Matthew and Granger, skeleton.
XXXIV.— *Ardops nichollsi* sp. nov., fossil bat from Porto Rico.
XXXV–XLIII.— *Kogia breviceps*, skull.
XLIV (colored).— *Epomophorus anurus*, *Epomops franqueti franqueti*, *Eidolon helvum*, *Hypsignathus monostrosus*, heads of males.
XLV.— *Epomops franqueti franqueti*, adult male and young female.
XLVI, XLVII.— *Epomophorus anurus.*
XLVIII.— *Taphozous mauritianus* and *Mops trevori.*
XLIX.— *Saccolaimus peli*, two views of head.
L.— *Lavia frons affinis*, front and side views of head.
LI.— *Hipposideros gigas niangaræ* and *Rhinolophus axillaris*, front view of head.
LII.— *Hipposideros caffer centralis* (side view of head) and *Machærhamphus anderssoni* (head and bill from above).
LIII.— *Chærephon* (*Lophomops*) *cristatus* and *Myopterus albatus*, side views of head.
LIV.— *Mops congicus* and *Chærephon russatus*, group showing position when suspended at rest.
LV.— *Machærhamphus anderssoni* pursuing *Mops faradjius.*
LVI.— *Phyllonycteris major* sp. nov., *Monophyllus frater* sp. nov., fossil from Porto Rico.
LVII–LX.— Salamanders from mountains of North Carolina.
LXI.— *Clemmys nuchalis* sp. nov., type.
LXII, LXIII.— West Indian Earwigs (Dermaptera).
LXIV–LXXXIII.— Fresh-water Fishes of the Congo Basin. (Plates LXXX–LXXXIII, colored.)
LXXXIV–LXXVII.— *Hydrocyon lineatus* and its supposed allies, dentition.
LXXXVIII.— Fossil Fishes from the Belgian Congo.
LXXXIX, XC.— Skiagraphs of *Scutisorex congicus* and *Crocidura turba nilotica.*
XCI.— *Scutisorex congicus*, animal.
XCII.— *Crocidura nyansæ kivu*, animal.
XCIII.— *Cerathyla johnsoni* sp. nov., type and paratypes.
XCIV.— *Hyloscirtus fuhrmanni* (Paraca).
XCV.— Vegetation in the Santa Rita Valley, Colombia, type locality of *Cerathyla johnsoni* sp. nov.
XCVI.— Santa Rita Creek, Colombia, the habitat of *Hyloscirutus fuhrmanni.*
XCVII.— View looking eastward across the Animas Valley at Cedar Hill, New Mexico, showing exposures of Torrejon beds.

XCVIII.— Small exposure of the Tiffany beds, Colorado.
XCIX–CII.— *Nothodectes gidleyi,* skull and dentition.
CIII–CVI.— Dentition of *Notharctus.*
CVII.— *Aphanolemur gibbosus,* type.
CVIII–CX.— Anatomy and reproductory organs of *Cladorchis gigas* sp. nov.
CXI.— Florida Ground Sharks.

TEXT FIGURES.

PAGE.
Wunderia neœriatella gen. et sp. nov., venation of 133
Map, showing Pre-Cambrian and Triassic diabase in eastern Pennsylvania .. 182
Dinemellia dinemelli, Hypargos dybowskii, Clytospiza monteiri, Parmoptila jamesoni, Nigrita fusconota, wings 245
Mouth and head of young white Java Sparrow (*Munia oryzivora*), about 4 days old 248
Vidua serena, Xanthophilus capensis and *Textor albirostris,* skulls 250
Xanthophilus capensis and *Textor albirostris,* sterna 250
Textor albirostris, foot of female 251
Philetarius socius, head and wing 253
Parmoptila jamesoni and *Nigrita fusconota,* bill and head 255
Vidua serena and *Coliuspasser concolor,* tails, with diagrammatic cross-sections 257
Steganura paradisea and *Dendroica striata,* showing areas of thin bone on top of the braincase 258
Diagram to illustrate the apparent development of the Ploceidæ 264
Correlation diagram of principal formation in which horned dinosaurs are found 281
Sketch map showing principal areas in which horned dinosaurs are found ... 283
Ventral view of sternal plates showing cartilaginous attachments in *Monoclonius* 292
Dorsal view of sternal plates showing cartilaginous attachments in *Monoclonius* 293
Diatryma steini, reconstructed skeleton 310
Utetheisa ornatrix, Porto Rico; *U. pulchella,* India; *U. semara,* Java; comparative figures of genitalia 342
Empyreuma affinis and *E. anassa,* comparative views uncus 343
Dew-point apparatus 350
Apatosaurus minimus sp. nov., sacrum and ilia 359
" " " outline of right pubis and right ischium 360
Kogia breviceps, right periotic of adult 395
Saccolaimus peli and *Eidolon helvum,* outline drawings showing how the ear was measured by the collectors 407
Map of the Congo and Lake Region of Africa, showing localities where bats were collected by the Congo Expedition 415
Hypsignathus monstrosus, direct front view of head, adult male 419
Nycteris avakubia, head, from field sketch of type 426
Hipposideros langi, head of adult male, showing nose-leaves and frontal sac .. 435
" " pubic region of female 436
" " pubic region of male, (*A*), anal sac invaginated; (*B*), anal sac everted 437

PAGE.
Glauconycteris humeralis and *G. alboguttatus*, showing white markings of shoulders and back 448
Kerivoula cuprosa, skull of adult female 452
Chærephon (*Lophomops*) *chapini*, adult male (type). *A*, side view of head, crest erect; *B*, view of crown, crest erect; *C*, same view, crest laid back 462
" " *cristatus*, adult male. *A*, crest erect; *B*, crest laid back 464
" " *abæ*, crown view of head, male and female 465
Mops (*Allomops*) *osborni*, skull of type, adult male 470
" " " skull of adult female 471
" " " crown of male type, showing the small crest on back of frontal membrane 473
" " *occipitalis*, skull of type 475
Hypsignathus monstrosus, tongue of adult male, from above 485
Rhinopomidæ (*Rhinopoma microphyllum*), *Emballonuridæ* (*Taphozous mauritianus*), *Nycteridæ* (*Nycteris arge*), and *Molossidæ* (*Nyctinomus ansorgei*), intefemoral membranes 495
Hypsignathus monstrosus, head of adult male 593
" " dissection showing pharyngeal sacs, hyoid bones, larynx, and general arrangement of viscera 506
" " sagittal section of adult male, showing pharynx, vocal organs and viscera 507
Saccolaimus peli, wing from above, to show folding of tip 515
Mimetillus moloneyi and *Lavia frons*, showing difference in relative wing-area. 537
Miniopterus inflatus, head of male 540
" " left wing from below, showing tip folded 541
Chærephon russatus, wing 550
Mops (*Allomops*) *osborni*, right foot from below to show spoon hairs 556
Zanycteris paleocenus gen. et sp. nov., right maxilla, palatal view 570
Plethodon yonahlossee sp. nov., roof of mouth to show dentition 599
" *glutinosus* " " " " " " 603
" *metcalfi* " " " " " " 605
Spelerpes ruber schencki " " " " " " 614
" *guttolineatus* " " " " " " 616
Clemmys nuchalis sp. nov., side view of head 624
" *muhlenbergi*, side view of head 624
Map of Congo and Lake Region of Africa, showing localities where fishes were collected by the Congo Expedition 693
Marcusenius osborni, type 668
" *retrodorsalis*, type 669
Pellonula tenuis, type 675
" *congica* (Regan) 676
Alestes carmesinus 682
Microstomatichthyoborus bashforddeani gen. et sp. nov., type 685
Nannæthiops tritæniatus Boulenger 686
Labeo cyclopinnis, type 691
" *sorex*, type 692
" *intermedius*, type 694

PAGE.
Discognathus ornatus, type 696
Barbus atromaculatus, type 698
" *rubripinnis*, type 699
" *dolichosoma*, type 700
" *candens*, type 701
Barilius salmolucius, type 703
Engraulicypris congicus, type 704
Clarias zygouron, type 705
" *malaris*, type 706
Eutropius gastratus, type 709
Gnathobagrus depressus, type 712
Amarginops platus, type, lateral and dorsal views 714
Amphilius notatus, type 715
Synodontis tenuis, type 718
Acanthocleithron chapini, type 721
Doumea alula, type 722
Haplochilus platysternus, type 724
Paratilapia longipinnis, type 728
" *xenodon*, type 729
Lamprologus obliquus, type 732
Map of Africa, indicating divisions used in discussion of the ichthyfauna.. 741
Map of Botanical regions of Africa (after Engler) 744
Erythrinus, *Hydrocyon forskalii*, *Citharinus*, suspensorial and mandibular apparatus 758
Lepidotus congolensis, left premaxilla, inner view, anterior extremity of maxilla, the teeth and fragment of parasphenoid.. 762
" " left suboperculum, outline of a pelvic basalia, and fulcra attached to a front fin-ray 763
" " scales from different parts of the fish 764
Crocidura nyansæ kivu and *Scutisorex congicus*, skulls and lower jaws (side and ventral views) 770
Crocidura nyansæ kivu and *Scutisorex congicus*, skulls (ventral view) and lower jaws (dorsal view) 771
Crocidura nyansæ kivu and *Scutisorex congicus*, skulls (dorsal view) and lower jaws (ventral view) 772
Scutisorex congicus, vertebræ 775
Crocidura nyansæ kivu and *Scutisorex congicus*, vertebral columns, dorsal view. 776
Crocidura nyansæ kivu and *Scutisorex congicus*, vertebral columns, ventral views 777
Crocidura nyansæ kivu and *Scutisorex congicus*, vertebral columns, lateral views 778
Crocidura nyansæ kivu and *Crocidura congicus*, skeletons, side view 779
Ontogeny of terminal phalanges from an *Eleutherodactylus* to a *Leptodactylus* type 796
Cerathyla johnsoni, ventral view of shoulder girdle 802
" " dorsal view of sacral vertebra 803
Hyloscirtus fuhrmanni, dorsal view of sacral vertebra 805
" " ventral view of shoulder girdle 805
Cerathyla panamensis, sections through dorsal cover of the type specimen.. 809

PAGE.
Diplodocus, scapula, coracoid, and femur........ 816
Diplodocus, limb bones........ 818
Sketch map of a portion of the San Juan Basin........ 823
Superior view of culminicorn and narial tubes and anterior view of right narial tube of *Diomedea exulans* and *D. sanfordi*........ 862
Cladorchis gigas sp. nov. Details of reproductory organs........ 870
Gobiesox yuma sp. nov., type........ 876

LIST OF HIGHER GROUPS, GENERA, SUBGENERA, SPECIES, AND SUBSPECIES DESCRIBED OR RENAMED IN THIS VOLUME.

Higher Groups.

Heptaxodontinæ Anthony........ 186
Heteropsomyinæ Anthony........ 189
Diatrymæ Matthew and Granger........ 321
Diatrymidæ Matthew and Granger........ 321
Scutisoricinæ Allen........ 781

Genera and Subgenera.

Wunderia Grossbeck........ 133
Tegoribates Ewing........ 158
Heptaxodon Anthony........ 183
Homopsomys Anthony........ 187
Dexosarcophaga Townsend........ 221
Euloewiopsis Townsend........ 222
Opsophasiopteryx Townsend........ 222
Euscopoliopteryx Townsend........ 223
Trichinochæta Townsend........ 224
Parodomyia Townsend........ 225
Trochiloleskia Townsend........ 226
Ommaleskia Townsend........ 227
Cyanopsis Townsend........ 228
Diaphanomyia Townsend........ 229
Atactopsis Townsend........ 229
Paratactopsis Townsend........ 230
Thysanopsis Townsend........ 231
Paraphasiopsis Townsend........ 232
Syringosoma Townsend........ 232
Alloperdita Viereck........ 241
Microsiphonorhis Chapman........ 329
Lophomops Allen........ 460
Allomops Allen........ 470

	Page.
Zanycteris Matthew	569
Formicilabia Rehn and Hebard	641
Microstomatichthyoborus Nichols and Griscom	685
Gnathobagrus Nichols and Griscom	711
Amarginops Nichols and Griscom	713
Acanthocleithron Nichols and Griscom	720
Aphanolemur Granger and Gregory	856
Rhothonia Murphy	861

Species and Subspecies.

Cobubatha olivacea Grossbeck	69
Eois davisi Grossbeck	90
Selidosema cypressaria Grossbeck	96
Thyridopteryx pallidovenata Grossbeck	104
Dolichorrhinia planatella Grossbeck	131
Diviana verecuntella Grossbeck	132
Wunderia neæriatella Grossbeck	133
Calera albicostella Grossbeck	134
Pterophorus simplicius Grossbeck	136
“ *perplexus* Grossbeck	136
Bdella tenuirostris Ewing	149
“ *peregrina* var. *iowaensis* Ewing	150
Scirus simplex Ewing	150
Eupalus parvus Ewing	151
Raphygnathus pectinatus Ewing	151
Tenuipalpus erythreus Ewing	152
Erythræus phalangiolus Ewing	153
“ *quadratus* Ewing	153
Atomus niger Ewing	154
“ *longilinea* Ewing	155
Eutrombidium corticis Ewing	155
Enemothrombium ovalis Ewing	156
“ *penicillifer* Ewing	156
Allothrombium pulvinus Ewing	157
Trachyuropoda longa Ewing	158
Tegoribates subniger Ewing	159
Trachyoribates zeteki Ewing	159
Peloribates iowaensis Ewing	160
Oribatella achipteroides var. *australis* Ewing	160
Oribata quadrisetosa Ewing	161
Liacarus fusiformis Ewing	161
Cultroribula confinis var. *magna* Ewing	162
Oribatula clavata Ewing	162
Tegeocranus subniger Ewing	163
Damæus minutus Ewing	164
“ *brevitarsus* Ewing	164
Phthiracarus pectinatus Ewing	165

	PAGE.
Pigmeophorus quadratus Ewing	166
Heptaxodon bidens Anthony	183
Homopsomys antillensis Anthony	187
Dexosarcophaga transita Townsend	221
Amobiopsis ornata Townsend	221
Paratheresia brasiliensis Townsend	222
Euloewiopsis setosa Townsend	222
Opsophasiopteryx mima Townsend	223
Euscopoliopteryx nebulosa Townsend	224
Trichinochæta orbitalis Townsend	224
Polygaster brasiliensis Townsend	224
Parodomyia paradoxica Townsend	226
Eucelatoria australis aurescens Townsend	226
Trochiloleskia flava Townsend	227
Ommaleskia fumosa Townsend	227
Copecrypta ruficauda devia Townsend	227
Neoarchytas inambarica aurifrons Townsend	228
Cyanopsis costalis Townsend	228
Diaphanomyia aurea Townsend	229
Atactopsis facialis Townsend	229
Paratactopsis setosa Townsend	230
Thysanopsis albicauda Townsend	231
Zygosturmia protoparcis meridionalis Townsend	231
Ypophæmyia malacosomæ brasiliensis Townsend	231
Paraphasiopsis mellicornis Townsend	232
Syringosoma pennipes Townsend	233
Xanthomelanopsis brasiliensis Townsend	233
Andrena (Andrena) æquatorialis Viereck	235
“ “ *boswendica* Viereck	236
Perdita (Cockerellia) bequærti Viereck	241
Monoclonius nasicornus Brown	286
“ *cutleri* Brown	301
Diatryma steini Matthew and Granger	322
Oreopeleia leucometopius Chapman	327
Microsiphonorhis brewsteri Chapman	329
Microligea montana Chapman	330
Sylvilagus gabbi consobrinus Anthony	335
Phyllops vetus Anthony	337
Empyreuma anassa Forbes	343
Lymire candida Forbes	344
“ *senescens* Forbes	345
Apatosaurus minimus Mook	358
Nycteris pallida Allen	425
“ *avakubia* Allen	426
Rhinolophus abæ Allen	428
“ *axillaris* Allen	429
Hipposideros caffer niapu Allen	431
“ *abæ* Allen	432
“ *nanus* Allen	434

	Page.
Hipposideros langi Allen	434
“ *gigas niangaræ* Allen	438
Pipistrellus abaensis Allen	442
Eptesicus ater Allen	443
“ *faradjius* Allen	444
“ *garambæ* Allen	445
Glauconycteris humeralis Allen	448
“ *alboguttatus* Allen	449
Miniopterus breyeri vicinior Allen	450
Nyctinomus ochraceus Allen	455
Chærephon frater Allen	456
“ *russatus* Allen	458
“ (*Lophomops*) *chapini* Allen	461
“ “ *cristatus* Allen	463
“ “ *abæ* Allen	464
Mops congicus Allen	467
“ *niangaræ* Allen	468
“ *trevori* Allen	469
“ (*Allomops*) *osborni* Allen	473
“ “ *occipitalis* Allen	474
“ “ *faradjius* Allen, Lang and Chapin	476
“ “ *nanulus* Allen, Lang and Chapin	477
Monophyllus frater Anthony	565
Phyllonycteris major Anthony	567
Zanycteris paleocenus Matthew	569
Plethodon yonahlossee Dunn	598
Clemmys nuchalis Dunn	624
Formicilabia caribea Rehn and Hebard	642
Prolabia dominicæ Rehn and Hebard	643
“ *jamaicana* Rehn and Hebard	645
Marcusenius osborni Nichols and Griscom	667
“ *retrodorsalis* Nichols and Griscom	668
Pellonula tenuis Nichols and Griscom	675
Alestes carmesinus Nichols and Griscom	681
Microstomatichthyoborus bashforddeani Nichols and Griscom	685
Distichodus langi Nichols and Griscom	687
Labeo cyclopinnis Nichols and Griscom	690
“ *sorex* Nichols and Griscom	691
“ *intermedius* Nichols and Griscom	694
Discognathus ornatus Nichols and Griscom	696
Barbus atromaculatus Nichols and Griscom	697
“ *rubripinnis* Nichols and Griscom	699
“ *dolichosoma* Nichols and Griscom	700
“ *candens* Nichols and Griscom	701
Barilius salmolucius Nichols and Griscom	702
Engraulicypris congicus Nichols and Griscom	703
Clarias zygouron Nichols and Griscom	704
“ *malaris* Nichols and Griscom	705
Eutropius gastratus Nichols and Griscom	708

	PAGE.
Gnathobagrus depressus Nichols and Griscom	712
Amarginops platus Nichols and Griscom	713
Amphilius notatus Nichols and Griscom	715
Synodontis tenuis Nichols and Griscom	717
Acanthocleithron chapini Nichols and Griscom	721
Doumea alula Nichols and Griscom	722
Haplochilus platysternus Nichols and Griscom	724
Paratilapia longipinnis Nichols and Griscom	728
" *xenodon* Nichols and Griscom	729
Lamprologus obliquua Nichols and Griscom	731
Lepidotus congolensis Hussakof	761
Cerathyla johnsoni Noble	798
Nothodectes gidleyi Matthew	832
Notharctus matthewi Granger and Gregory	847
" *osborni* Granger and Gregory	848
" *pugnax* Granger and Gregory	853
Aphanolemur gibbosus Granger and Gregory	856
Diomedea (Rhothonia) sanfordi Murphy	861
Cladorchis gigas MacCallum	867
Gobiesox yuma Nichols	876

ERRATA.

Page 6, line 19 from bottom, for *Papilo* read *Papilio.*
" 415, line 5 from top, for 18. " *frater* read 18. *Chærephon frater.*
" 491, line 12 from bottom, for *niagara* read *niangaræ.*
" 508, line 11 from bottom, for *Ephomophorus* read *Epomophorus.*
" 586, top line, second column, for *cuculata* read *cucullata.*
" " line 8 from top, for *equinoctialis* read *æquinoctialis.*
" 655, line 7 from bottom, for *Peterius* read *Petersius.*
" 657, line 15 from top, for *Eutropius congolensis* read *Eutropius congensis.*
" 749, line 4 from top, for *Shilbe* read *Schilbe.*
" 774, second line of table, for 1st " read 1st Dorsal.
" 780, line 11 from top, in nearly equal points, interlocking, omit comma.
" 858, in description of Plate CIII, Fig. 8, for 1146 read 11461.
" 859, " " " " CV, " 4, " " " "
" " " " " " CVI, for Fig. 3 read Fig. 2a.
" " " " " " " " Fig. 4 " Fig. 3.
" " " " " " " " Fig. 5 " Fig. 6.
" " " " " " " " Fig. 6 " Fig. 5.

BULLETIN

OF THE

AMERICAN MUSEUM OF NATURAL HISTORY.

VOLUME XXXVII, 1917.

59.57,8(75.9)

Article I.—INSECTS OF FLORIDA.[1]

IV. LEPIDOPTERA.

BY JOHN A. GROSSBECK. (Edited by Frank E. Watson).

PREFACE.

[This paper, long overdue, would have been in the reader's hands before this but for the untimely death of the author in Barbados, April 8, 1914. It was supposed that the manuscript was practically ready for the printer, but it was found, after carefully looking through it, that, although complete, it was unchecked, *i. e.*, in a preliminary stage. With the exception of a few scattered pages and the section on the Geometridæ, all the manuscript was typewritten. This family being Mr. Grossbeck's specialty, he evidently left it for the last, perhaps having in mind some changes or additions which he wished to incorporate. The author had made, throughout, changes and additions to the original manuscript but it was, for the most part, uncorrected. It was evidently his intention to entirely rewrite it before sending it to the printer.

The notes and records by the editor are enclosed in square brackets. The work of editing has proceeded slowly, being interrupted by several expeditions, as well as by routine work. One of these expeditions, the third sent to Florida by this Museum and referred to in detail below, while delaying this publication, has enabled us to add a great many records to this list. In going over the list of Hesperiidæ, the writer found it necessary to make many changes in the genus *Thanaos*, so that this section has been practically rewritten. Where records as given by Mr. Grossbeck have been transferred to another species, the same has been indicated, thus preserving their identity. In order to obtain exact identifications of the *Thanaos* taken on the third expedition, genitalic slides were made of all the species, and of a large number of the specimens captured.

---

[1] Through an oversight, part III of this series of papers (List of the Carabidæ of Florida by Charles W. Leng, Bull. Amer. Mus. Nat. Hist., XXXIV, 1915, pp. 555–601) was not given a general heading and serial number.

There being so few records from northern Florida, it was decided to make a survey of this portion of the state. Mr. A. J. Mutchler and the writer were in the state from September 25 to October 21, 1914, and collected between Jacksonville and Pensacola, the itinerary in detail being as follows: Jacksonville, Sept. 25–26; Gainesville and vicinity, Sept. 26 to Oct. 3; Monticello and vicinity, Oct. 4 to 8; Pensacola and vicinity, Oct. 10 to 14; Crestview, Oct. 15 and 16; De Funiak Springs and vicinity, Oct. 17 to 19; Jacksonville, Oct. 21. We were greatly assisted while at Gainesville by Mr. J. R. Watson, Entomologist of the Agricultural Experiment Station, who was most generous with his time and allowed us to go over the collections at the University from which we obtained a number of interesting records. He also sent to the Museum a large number of insects, including Lepidoptera, for identification and we have added many of these records to the list. We take this opportunity to express our thanks to Mr. Watson for his many kindnesses.

To enable anyone to readily locate, on the map, the less well known places visited by the writer, the following details are given:

Gainesville; for this region see the Arredondo Sheet, U. S. Geological Survey.

Agric. Exp. Sta. grounds, about one mile west of Gainesville.

Devils Mill Hopper, about six miles northwest of Gainesville.

East Gainesville, the region between the town and a point about three and one-half miles directly east of same.

Hogtown Creek, about three miles west of Gainesville.

Payne Prairie or Alachua Lake, about two and one-half miles south of Gainesville.

Lake Miceosukee, the region around a small eastern arm of the lake and about three miles northwest of Monticello.

Fort Barrancas, on the Gulf of Mexico, about seven miles southwest of Pensacola.

Fisherville, about one mile southwest of Pensacola.

Bayou Chico, about two miles southwest of Pensacola.

Star Lake or Spanish Grant, about three miles southwest of Pensacola.

Big Bayou (between the bayou and the coast), about four miles southwest of Pensacola.

Crestview, near Santa Rosa Co., in Walton Co.

Lake Stanley, about three miles northwest of De Funiak Springs.

In a list of this kind many errors and omissions occur. We would greatly appreciate information concerning any such and would also like to receive new records, all of which will be helpful should a supplement to this list be desirable.

FRANK E. WATSON.]

INTRODUCTION.

The Lepidoptera of Florida are especially interesting to students of the North American fauna because of the West Indian element which forms so marked a portion of the more southern parts of the state. For the most part this foreign element does not extend northwardly along the Atlantic States, which is explained largely by the fact that the larvæ are dependent for food upon plants which are not found there. Strong winged adults, as, for example, the Sphingidæ and some of the Noctuidæ, are frequently found as far north as Canada but the larvæ, except for a few cases, occur there only by accident: a gravid female, for instance, depositing eggs on its food plant which she has found in some garden. In such instances hibernation is never successfully effected and another brood of larvæ is again dependent upon a chance wanderer.

No complete list of Florida Lepidoptera has yet been made, though Dyar[1] has given a list of species found in the winter months in the vicinity of Lake Worth. The present list is based not only on material secured by the two Museum expeditions made in 1911 and 1912, but an effort has been made to compile all the records found in the literature, in the Museum and in some other collections which were gone over.

To Mr. Wm. T. Davis who accompanied both of the Museum expeditions and made a third independently in 1913, and to Dr. J. H. McDunnough who accompanied the second (1912) expedition, the writer is especially indebted for records or the loan of material. To Mr. Chas. E. Sleight, likewise, the author owes thanks for the loan of specimens. Thanks are also due Mrs. Annie Trumbull Slosson for permission to copy the records from her excellent collection of Florida Lepidoptera.

In preparing this list, Dyar's Catalogue has, in the main, been followed but, where any of the groups have been superceded by later revisions, such revisions have usually been my guide. Rothschild and Jordan have thus been followed in the Papilionidæ and Sphingidæ; Hampson in the Amatidæ and Arctiidæ; Dyar in the Hesperiidæ, Nymphulinæ, etc.; Barnes and McDunnough in the Megathymidæ and Cossidæ; and Prout in the Geometridæ, as far as he has revised that family. Hampson's Catalogue of the Noctuidæ forms an exception; this is only partially complete and to follow it would necessitate the arrangement at the end of the family of a large residue of species, which would be in accord with no published work. Where recent revisions have been used, cross-reference has always been made to Dyar's Catalogue and, in the case of the Noctuidæ, the genera to which Hampson refers the species are also given in parentheses. The cross-references will enable anyone using this list to locate the species in Dyar's or Hampson's Catalogue with facility.

---

[1] Proc. Ent. Soc. Washington, IV, 1900, pp. 446–485.

In order to render this paper more useful than a bare list of species would be, I have endeavored to give some idea of the distribution of the individual species. The distribution as given may be far from complete but monographs, reviews, local lists and general works covering the species of a particular region have been taken into consideration. The Antilles and Central and South America, including Mexico, as well as our own Gulf States, particularly southern Texas, have not yet been thoroughly explored and when this is accomplished the distribution of many of the species enumerated may be vastly extended. Especially is this true as regards the Tineoidea.

Mr. W. D. Kearfott looked over most of the Pyralidæ and either named or verified the material in this family. Dr. H. G. Dyar is responsible for working up the whole of the Phycitinæ, but he declined to describe the new species discovered. It is with much pleasure and thanks that I acknowledge the assistance of these two gentlemen.

PAPILIONIDÆ.

Papilio philenor *Linn.* (*Laertias*). St. Augustine, June, July, very rare (Johnson); Apalachicola (Chapman); Gulf Hammock (Castle and Laurent); Enterprise, Apr. (Castle and Laurent, Schwarz); La Grange, Sept. 10, 11 (Ds., Sleight); Lakeland, Mar. 28, May 5, 6, Nov. 8, Fort Myers, Apr. 25 (A. M. N. H., Ds.); Lake Josephine (J. and H. Comstock); [common at Devils Mill Hopper, Gainesville, Sept. 27; common, East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Monticello, Oct. 5; Bayou Chico, Pensacola, Oct. 12; Crestview, Oct. 15 and 16].

Larva on *Aristolochia serpentaria, A. sipho* and *Asarum canadense.* Eggs have been laid on *Polygonum.*

Extends to Southern Canada, through Colorado and Arizona to California and into Mexico. A form occurs in Tres Marias Islands.

Papilio devilliers *Godt.* "Lower extremity of Florida" (Skinner).

Occurs in Cuba.

Papilio polydamus *Linn.* Indian River (Wittfeld).

Extends northward into Georgia and southward through Mexico and the Antilles to Argentina. Many of the West Indian Islands have distinct subspecies.

Papilio polyxenes asterias *Cram.* Jacksonville, Apr. (Castle and Laurent), Sept. 7 (Sleight); St. Augustine, Feb. to Sept. (Johnson); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); Lakeland (McD.), Nov. 8 (Ds.); Lake Worth, Feb. (Dyar); Fort Myers, Mar. 31, Apr. 1, 25, Punta Rassa, Apr. 3, La Belle, Apr. 27, 28; South Bay, Lake Okeechobee, Apr. 30, May 2, larvæ and adults common at edge of Everglades (A. M. N. H., Ds.); Miami, common (Laurent); [East Gainesville, Sept. 28 and 29; Fort Barrancas, Oct. 10].

Larva on *Daucus carota, Conium maculatum, Cicuta maculata, C. virosa, C. bulbifera, Sium cicutæfolium, Apium divaricatum, A. graveolens, A. petroselinum, Discopleura capillacea, Carum carui, Amethum graveolens, Fœniculum vulgare, Archangelica, Tiedemannia, Pastinaca sativa* and *Ruta graveolens.*

Extends to Canada, California and Honduras; occurs also in the Antilles according to Skinner. The typical form is found in Cuba. Other forms occur in Mexico, South America and the Newfoundland-Anticosti region.

Papilio thoas *Linn.* Though one of the many forms of this species occurs in Cuba, there is no authentic record of its having been taken in Florida.

Papilio cresphontes *Cram.* (not *thoas* Linn.). St. Augustine, Mar. to Oct. (Johnson); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 10 (Sleight); Lakeland, Mar. 28, May 5, Nov. 7 (A. M. N. H., Ds.); Punta Gorda, Feb. (Sloss.), May 5 (A. M. N. H.); Useppa, Apr. (Ds.); Lake Worth, Feb. (Dyar); South Bay, Lake Okeechobee, Apr. 30, La Bella, Apr. 7, Fort Myers, Mar. 30, Punta Rassa, Apr. 3, Marco, Apr. 18, Everglade, Apr. 4, 10, Chokoloskee, Apr. 8 (A. M. N. H., Ds.); Miami, common (Laurent); Key West, Sept. 18 (Ds.); [Jacksonville, Sept. 26; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5 and 7; Pensacola, Oct. 10; De Funiak Springs, Oct. 19; near De Funiak Springs (G. C. Fisher)].

Larva on orange, lemon, *Ptelea trifoliata, Zanthoxylum americanum, Z. clava-herculis, Dictamnus fraxinella, Nyssa multiflora, Persea carolinensis* and *Populus dilatata* and, in Cuba, on *Piper peltatum, P. umbelatum* and *P. mollicornum.*

Extends to Montreal, Wisconsin and Iowa, and Costa Rica and Cuba.

Papilo aristodemus *Esper.* (*cresphontinus* Martyn). Key West (Skinner).

Occurs in Cuba and Haiti.

Papilio ponceana *Schaus.* Miami (Schaus). Described from Miami and not since found.

Papilio andræmon bonhotei *Sharpe.* Miami (Holland).

Occurs in the Bahamas. The typical form occurs in Cuba and another subspecies is found on Great Cayman Island.

Papilio glaucus *Linn.* Yellow form, **turnus** *Linn.* Jacksonville, Sept. 7 (Sleight); St. Augustine, May, June and July (Johnson); Lakeland, Mar. 28 (A. M. N. H.); Punta Gorda, Feb. (Sloss.); [Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28; Payne Prairie, Gainesville, Oct. 2; Lake Miceosukee, Monticello, Oct. 6 and 8; Star Lake, Pensacola, Oct. 13].

Black form, **glaucus** *Linn.* St. Augustine, May, June and July (Johnson); Indian River (Schwarz, Palmer); [Payne Prairie, Gainesville, Oct. 2; Lake Miceosukee, Monticello, Oct. 6 and 8; De Funiak Springs, Oct. 17].

Variety **australis** *Mayn.* Deep Lake, Apr. 13 (A. M. N. H.).

Larva on *Liriodendron tulipifera, Magnolia acuminata, Tilia americana, Prunus serotina, P. pennsylvanica, P. virginiana, P. americana,* cultivated cherry, plum, peach, *Pyrus malus, Cydonia vulgaris, Styrax americana, Fraxinus sambrucifolia,* swamp ash, " brown ash," *F. americana, Syringa* *vulgaris, Catalpa bignonioides, Sassafras officinale, Humulus lupulus,* hickory, *Quercus tinctoria, Betula alba, B. lenta, Alnus incana, Populus tremuloides,* willow and thorn, [*Ptelea trifoliata* and *Magnolia glauca*].

Extends to Newfoundland, Alaska, the Rocky Mts. and Texas. A small form, *canadensis* R. and J., is also found in the northern parts of this range.

Papilio troilus *Linn.* Apalachicola (Chapman); St. Augustine, June and July (Johnson); Lakeland, Mar. 28, May 6, 8 (A. M. N. H., Ds.); Punta Gorda, Feb. (Sloss.); Marco, Apr. 21 (A. M. N. H.); Allen River to Deep Lake, Apr. 12, 13 (A. M. N. H., Ds.); Miami (Laurent); [One seen on the wing at Lake Miceosukee, Monticello, Oct. 8; near De Funiak Springs (G. C. Fisher). These may be the form *texanus.*]

Variety **texanus** *Ehrm.* Florida, Aug. to Sept. (Pridday); Titusville, Aug. (Rothschild and Jordan); Indian River (A. M. N. H.); Lakeland, Apr. 18 (Ds.); Marco, May 8 (A. M. N. H.); Chokoloskee, June (Rothschild and Jordan); [Devils Mill Hopper, Gainesville, Sept. 27].

Larva on *Benzoin, Sassafras, Magnolia glauca, Xanthoxylum americanum, Prunus serotina, Prunus persica, Pyrus arbutifolia, Syringa vulgaris* and *Persea carolinensis.*

Extends northward to Canada and westward to the North West Territory, Wisconsin and Texas.

Papilio palamedes *Drury.* Ortega, Sept. 6 (Sleight); St. Augustine, spring and summer (Johnson); Gulf Hammock, Apr., Enterprise, Apr. 4 (Castle and Laurent); La Grange, Sept. 9 (Sleight); Titusville, Aug.-Sept. (Rothschild and Jordan); Indian River (Johnson, Wittfeld); Lakeland, Mar. 28, May 5 (A. M. N. H., Ds.); Avon Park, Feb. 20–Mar. 25 (J. and H. Comstock); Punta Gorda, Feb. (Sloss.); Lake Worth, Feb. (Dyar); Useppa, Apr. (Ds.); Fort Myers, Mar. 30, Allen River to Deep Lake, Apr. 12, 13, Everglade, Apr. 4 (A. M. N. H., Ds.); Everglade, rare (McD.); [Gainesville, Sept. 26; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Lake Miceosukee, Monticello, Oct. 8; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; De Funiak Springs, Oct. 17, near De Funiak Springs (G. C. Fisher)].

Larva on *Persea carolinensis* and *Magnolia glauca.*

Extends to New Jersey, Missouri and Texas. A form occurs in Mexico.

Papilio marcellus *Cram.* (*Iphiclides*). The name *ajax* Linn. has been found to be a synonym of *polyxenes* or of *glaucus.* St. Augustine, spring and summer (Johnson); Sanford (Rothschild and Jordan); Indian River (A. M. N. H.); Lakeland, Mar. 28, May 7 (A. M. N. H., Ds.); Lake Josephine (J. and H. Comstock); Punta Gorda, Feb. (Sloss.); Lake Okeechobee (Palmer, Wittfeld, Schwarz).

Form **floridensis** *Holl.* St. Johns River (Holland); Lakeland, May 5, 6, 8 (A. M. N. H., Ds.); Fort Myers, common, also young larvæ (McD.), Mar. 30, Apr. 1, 7, 10, 25, South Bay, Lake Okeechobee, Apr. 29 (A. M. N. H., Ds.).

Form **telamonides** *Feld.* Jacksonville, Apr., Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); St. Augustine (Johnson); Indian River (A. M. N. H.); [one very poor specimen taken at Lake Miceosukee, Monticello, Oct. 6. A specimen of this form from Gainesville, is in the collection of the Agric. Exp. Sta.].

Form **lecontei** *R. and J.* Lakeland, Nov. 8 (Ds.); [Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 8].

Larva on *Asimina triloba* and other species of *Asimina,* and rarely on *Ericaceæ* and *Lauraceæ.*

Extends to Southern Canada, Iowa and Texas; a specimen has been reported as captured on Vancouver Island.

Papilio celadon *Lucas* (*sinon* Fabr.; *Iphiclides*). "Southern Florida" (Skinner).

There seems to be no authentic record of this species from Florida. It occurs in Cuba. It has also been erroneously reported from California.

PIERIDÆ.

Tachyris margarita *Hbn.* Indian River (Edwards); Lake Worth (Dyar, Sloss.); Miami (Laurent), Jan. (Sloss.), Sept. 24 (Ds., Sleight).

Variety **neumoegenii** *Skinner.* Indian River (Neumoegen).

Extends to New York (as a straggler), Arizona and through the Antilles to South America.

Skinner says that all the Florida examples of this species belong to the variety *neumoegenii.* I have been unable to verify this by an examination of all the specimens reported from Florida so leave the records as I find them.

Pontia monuste *Linn.* St. Augustine, common during summer, some seasons large numbers are seen flying northward (Johnson); Enterprise, Apr. (Castle and Laurent); Indian River, Lakeland, May 7 (A. M. N. H.); Punta Gorda, Feb., Charlotte Harbor (Sloss.); Boca Grande, Apr., Useppa, Apr., May (Ds.); Fort Myers, Mar. 31, La Belle, Apr. 27, South Bay, Lake Okeechobee, Apr. 29, May 2 (A. M. N. H., Ds., McD.); Lake Worth (Dyar, Sloss.); Punta Rassa, Apr. 3, Marco, Apr. 17, 18, Everglade, Apr. 4, 7, 9, 10, 11, Chokoloskee, Apr. 8 (A. M. N. H., Ds., McD.); Miami, common (Laurent), Jan. (Sloss.); Key Largo, Nov. 6 (A. M. N. H.); Big Pine Key, Sept. 19 (Ds., Sleight).

Variety **phileta** *Fabr.* Indian River (A. M. N. H.); Lake Worth (Sloss.); Boca Grande, Apr., Useppa, Apr., May (Ds.); La Belle, Apr. 27, South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.).

Larva on cabbage, kale, lettuce, turnip, *Cleome* and *Polanisia.*

Extends to Georgia, Texas and through Mexico and the Antilles to South America.

Pontia protodice *Bd. and Lec.* "Florida" (Chapman, Abbott); Enterprise, Apr. (Castle and Laurent); [One male and one female, Monticello, Oct. 5; one male, Fisherville, Pensacola, Oct. 11; one specimen seen at Pensacola, Oct. 10. These were the only specimens observed].

Larva on *Brassica oleracea, Lepidium virginicum, Thlaspi, Alyssum maritinum,* turnip and mignonette.

Extends to Maine, southern Canada, the Pacific and into Mexico.

Pontia rapæ *Linn.* Apalachicola (Scudder); [Monticello, Oct. 4 and 7; Pensacola, Oct. 12; Bayou Chico, Pensacola, Oct. 12; De Funiak Springs, Oct. 17. Very few specimens seen at any of these localities. Specimens from Gainesville in the collection of the Agric. Exp. Sta.].

Larva on many cruciferous plants, cabbage, cauliflower, *Brassica napus, Nasturtium palustre, N. armoracia, Raphanus, Sinapis, Matthiola, Alyssum maritinum, Barbarea vulgaris, Cakile americana,* mignonette (*Reseda odorata*), [*Capsella bursa-pastoris,* garden nasturtium (*Tropæolum*)].

Extends to Labrador, and the Pacific Coast. Occurs also in Europe.

Nathalis iole *Bd.* Big Pine Key, Sept. 20 (Ds.).

Extends to Illinois, California and Mexico.

Callidryas eubule *Linn.* Jacksonville, Jan. 25 (Sloss.), Nov. 5 (A. M. N. H.); St. Augustine, common nearly the year around (Johnson); Lake Worth (Dyar); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 9, 10, 12 (Ds., Sleight); Titusville, Nov. 8, Indian River (A. M. N. H.); Lakeland, Mar. 28, Nov. 7, 8, 9, Fort Meade, May 5 (A. M. N. H., Ds.); Punta Gorda, Feb. (Sloss.); Fort Myers, Mar. 30, Apr. 1, 24, Nov. 15, La Belle, Apr. 18, Chokoloskee, Apr. 8 (A. M. N. H., Ds.); Miami, common (Laurent), Jan. (Sloss.); Biscayne Bay (Sloss.); "Florida Keys" (Palmer); [Jacksonville, Sept. 26 and Oct. 21; common, Devils Mill Hopper, Gainesville, Sept. 27; common, East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; common, Hogtown Creek, Gainesville, Oct. 1; common, Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4 and 5; Lake Miceosukee, Monticello, Oct. 6; Pensacola, Oct. 10 and 12; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; De Funiak Springs, Oct. 19; near De Funiak Springs (G. C. Fisher). Specimens from Gainesville, in the collection of the Agric. Exp. Sta.].

Variety **sennæ** *Linn.* [One male, East Gainesville, Sept. 28; two males, Hogtown Creek, Gainesville, Oct. 1; one male, Payne Prairie, Gainesville, Oct. 2.]

Larva on leguminous plants, *Cassia marylandica, C. chamæcrista, C. occidentalis* and clover.

Extends to Massachusetts, Wisconsin, California and through Mexico and the Antilles to Argentina.

Aphrissa statira *Cram.* Upper Indian River (A. M. N. H.); Lake Worth (Dyar); Miami, between Jan. 28 and Feb. 8 (Hebard).

Extends through the Antilles to South America; occurs also in Central America.

Phœbis argante *Fabr.* "Florida" (Dyar).

Extends to Texas and through Mexico and the Antilles to South America.

Phœbis agarithe *Bd.* Upper Indian River (A. M. N. H.); Indian River (Neumoegen); Lake Worth (Dyar); Punta Rassa, Apr. 3, Everglade, Apr. 4 (A. M. N. H., Ds.); Miami, common (Laurent), Jan. (Sloss.), Nov. 5 (A. M. N. H.); Key West, Sept. 17 (Ds.).

Larva on the various species of *Cassia* and on *Pithecolobium guadaloupensis.*

Extends to Illinois, Arizona and through Mexico and the Antilles to South America.

Zerene cæsonia *Stoll.* Jacksonville (Sloss.), Nov. 5 (A. M. N. H., Ds.); St. Augustine, Apr.–July (Johnson) La Grange, Sept. 9 (Sleight); Lakeland, May 6, Nov. 7 (A. M. N. H., Ds.); Seven Oaks (Thurston); Lake Josephine (J. and H. Comstock); Fort Myers, Mar. 30, Apr. 24, 25, 26 (A. M. N. H., Ds.); Miami (Laurent), Sept. 25 (Ds.); Biscayne Bay (Sloss.); [Devils Mill Hopper, Gainesville, Sept. 27; locally common between Hogtown Creek and Devils Mill Hopper, Gainesville, Sept. 27; somewhat common, East Gainesville, Sept. 28; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Lake Miceosukee, Monticello, Oct. 6 and 8; Monticello, Oct. 7; De Funiak Springs, Oct. 19].

Larva on *Trifolium, Amorpha fruticosa* and *A. californica.*

Extends to Staten Island, Ontario, California and through Mexico and the Antilles to South America.

Eurymus eurytheme *Bd.* "Southern Florida" (Holland).

Larva on clover.

This polymorphous species extends, in one or more of its many forms, to Hudson Bay, the Pacific Coast and Mexico.

Eurymus philodice *Godt.* "Western Florida" (Morrison); Lakeland, Mar. 28 (A. M. N. H.).

Larva on clover, [also on *Baptisia tinctoria*].

Extends to New England, the Rocky Mts. and Mexico.

Eurema nicippe *Cram.* Jacksonville (Sloss.), Spet. 7 (Ds.), Nov. 5 (A. M. N. H., Ds.); St. Augustine, Mar.–Nov., common (Johnson); Newberry, Nov. 19 (Ds.); Gulf Hammock, Apr. (Castle and Laurent); Enterprise, Nov. 9, Lakeland, May 5, Fort Myers, Mar. 30, Apr. 1, 26, Nov. 16, La Belle, Nov. 14 (A. M. N. H., Ds.); Useppa Is., May (Ds.); Miami, Jan. (Sloss.), Nov. 5 (A. M. N. H.); Key West (Maynard, Palmer); [Gainesville, Sept. 26 to Oct. 3rd; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Monticello, Oct. 4 to 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Pensacola, Oct. 10 and 12; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 15 and 16; De Funiak Springs, Oct. 17 and 19; near de Funiak Springs (G. C. Fisher); Jacksonville, Sept. 26 and Oct. 21. Specimens from Gainesville in the collection of the Agric. Exp. Sta. Common everywhere and especially abundant in the Gainesville region.]

Larva on *Cassia marylandica, C. tora, C. occidentalis, C. obtusifolia, Trifolium* sp. and other Leguminosæ.

Extends to Connecticut, the Great Lakes, through Kansas and Arizona to California and Mexico.

Eurema euterpe *Mén.* Jacksonville, Nov. 3, 5 (A. M. N. H., Ds.); Ortega, Sept. 6 (Ds.); St. Augustine, common throughout the year (Johnson); Newberry, Nov. 19 (A. M. N. H.); Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 9, 12 (Ds., Sleight); Titusville, Nov. 8, Indian River, Lakeland, Mar. 28, May 6, 7, Nov. 7, 10 (A. M. N. H., Ds.); Lake Worth (Dyar); Punta Gorda, Feb. (Sloss.), Nov. 5 (A. M. N. H.); Useppa, Apr. (Ds.); Fort Myers, (McD.), Mar. 30, 31, Apr. 1, 24, 26, 28, 29, Nov. 16, Citrus Center, May 3, Marco, Apr. 18, 30 (A. M. N. H., Ds.); Chokoloskee (Barnes); Miami (Laurent); Big Pine Key, Sept. 21, Key West, Sept. 13 (Ds.); "Florida Keys" (Burgess, Palmer, Maynard); [Jacksonville, Sept. 26 and Oct. 21; Gainesville, Sept. 26; Agric. Exp. Sta. grounds, Gainesville, Sept. 26 and 30; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5 and 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Pensacola, Oct. 10 and 12; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 15 and 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak

Springs, Oct. 18. Specimens from Gainesville, in the collection of the Agric. Exp. Sta. Very common everywhere.]

Variety **alba** *Strck.* La Grange, Sept. 10, 12 (Ds., Sleight); [Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 5 and 7; Lake Miceosukee, Monticello, Oct. 6; Fisherville, Pensacola, Oct. 11; Star Lake, Pensacola Oct. 13; Big Bayou, Pensacola, Oct. 14; Lake Stanley, De Funiak Springs, Oct. 18; De Funiak Springs, Oct. 19. Generally distributed about the regions visited by us but rather scarce.]

Larva on *Cassia chamæcrista, C. occidentalis, C. nictitans, Trifolium* and *Glycine.*

Extends to Connecticut, the Great Lakes, through Kansas to California, and into Mexico and the Antilles.

Eurema delia *Cram.* Jacksonville, Jan. 25, Punta Gorda, Feb., Charlotte Harbor (Sloss.); Lake Josephine, Feb. (J. and H. Comstock); [Devils Mill Hopper, Gainesville, Sept. 27; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 5 and 7; Lake Miceosukee, Monticello, Oct. 8; Fisherville, Pensacola, Oct. 11; common, Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; rather common, Crestview, Oct. 15 and 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18. A specimen from Gainesville in the collection of the Agric. Exp. Sta.]

Larva on *Cassia.*

Occurs in the Southern States.

Eurema jucunda *Bd. and Lec.* Jacksonville (Sloss.); St. Augustine, very rare (Johnson); La Grange, Sept. 9 (Ds.); Lakeland, May 5, 6, 7, 8 (A. M. N. H., Ds.); Avon Park, May (J. and H. Comstock); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Monticello, Oct. 5 and 7; Crestview, Oct. 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18].

Extends to Texas, Mexico and Central America.

Eurema gnatheme *Bd.* "Florida" (Dyar). [Mr. L. V. Coleman has four purchased specimens in his collection, marked Chokoloskee, Fla., Sept. Maynard records a specimen from Sanford, Oct. 1, 1887, under *Terias blakei* Maynard, which Dyar calls a variety of *E. gnatheme* Bd.

Food plant: *Cassia occidentalis* (E. S. Panton).]

Occurs in the Antilles.

NYMPHALIDÆ.

Colænis julia *Fabr.* Lake Worth (Dyar); Miami, between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.); Key Largo, Nov. 6 (A. M. N. H.).

Variety **delila** *Fabr.* Biscayne Bay (Sloss.).

Extends to Texas and through Mexico and the Antilles into South America.

Agraulis vanillæ *Linn.* Jacksonville, Sept. 7 (Ds., Sleight), Nov. 3, 5 (Ds.); St. Augustine, common, Apr.–Nov. (Johnson); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); Indian River (A. M. N. H.); Lakeland (McD.), Mar. 28, Nov. 7, 8, 10 (A. M. N. H., Ds.); Lake Josephine (J. and H. Comstock); Punta Gorda, Nov. 17 (A. M. N. H.); Charlotte Harbor (Sloss.); Useppa, Apr., May (Ds.); Lake Worth (Dyar); La Belle, Nov. 14, Marco, Apr. 18, Deep Lake, Apr. 13, Chokoloskee, Apr. 8, Miami, Nov. 5 (A. M. N. H., Ds.); Miami, common (Laurent), Jan. (Sloss.); Key Largo, Nov. 6 (A. M. N. H.); Key West, Sept. 16, 17 (Ds., Sleight); [Jacksonville, Sept. 26 and Oct. 21; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Pensacola, Oct. 10 and 12; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18; near De Funiak Springs (G. C. Fisher). Common everywhere.]

Larva on *Passiflora pallida.*

Extends to New Jersey, Colorado, Southern California and through Mexico and the Antilles to Argentina.

Euptoieta claudia *Cram.* Jacksonville, Nov. 5 (Ds.); St. Augustine, during summer, rare (Johnson); Lakeland, Nov. 8 (A. M. N. H.); Punta Gorda, Nov. 14 (Ds.); Allen River to Deep Lake, Apr. 12 (A. M. N. H., Ds.); Biscayne Bay (Sloss.); [Devils Mill Hopper, Gainesville, Sept. 27; Monticello, Oct. 7; Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 16; De Funiak Springs, Oct. 19].

Larva on *Passiflora incarnata, P. cœrulea, Podophyllum peltatum, Sedum, Desmodium, Portulaca,* violets and garden pansy.

Extends to Massachusetts, Montreal, Alberta, California and through Mexico to South America.

Semnopsyche diana *Cram.* "Florida" (Skinner).

Larva on violets.

Extends to Ohio and Missouri.

Argynnis cybele *Fabr.* "Florida" (Skinner). [A specimen from Gainesville, in the collection of the Agric. Exp. Sta.].

Larva on the various species of violets.

Extends to Quebec and Colorado. The race *carpenterii* Edw. occurs in Arizona and New Mexico.

Apatura misippus *Linn.* Banana River (Cory); Indian River (Wittfeld).

Larva on various malvaceous plants and common *Portulaca.*

Occurs in the Antilles, the Guianas, India, Africa and Australia.

Phyciodes phaon *Edw.* Pablo Beach, Sept. 5, 27 (Ds., Sleight); Enterprise, Apr. (Castle and Laurent); Titusville, Nov. 8, Lakeland, May 8, Nov. 7 (A. M. N. H., Ds.); Avon Park, May (J. and H. Comstock); Useppa, Apr. (Ds.); Fort Myers, Mar. 30, 31, Apr. 1, 2, 23, 26, May 8, Nov. 7, 10, 13, La Belle, Apr. 27, Nov. 14, South Bay, Lake Okeechobee, May 2 (A. M. N. H., Ds.); Lake Worth (Dyar); Marco, Apr. 18, 21, Allen River to Deep Lake, Apr. 12, Everglade, Apr. 7, (A. M. N. H., Ds.); Miami, common (Laurent); Biscayne Bay (Sloss.); Key West, Sept. 16–18 (Ds., Sleight); [common, East Gainesville, Sept. 28 and 29; Big Bayou, Pensacola, Oct. 14. A specimen from Gainesville, in the collection of the Agric. Exp. Sta.]

Extends to Texas and Mexico; has also been reported from Kansas.

Phyciodes tharos *Drury.* Titusville, Nov. 8 (A. M. N. H.); St. Augustine, common most of the year (Johnson); La Grange, Sept. 9 (Ds., Sleight); Lakeland, May 4, 5, 6, 8, Nov. 7, Punta Gorda, Nov. 16 (A. M. N. H., Ds.); Fort Myers (McD.), Apr. 26, Deep Lake, Apr. 13, Everglade, Apr. 3 (A. M. N. H., Ds.); [common, East Gainesville, Sept. 28 and 29; Monticello, Oct. 7; Lake Miccosukee, Monticello, Oct. 8; Fisherville, Pensacola, Oct. 11; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 14; De Funiak Springs, Oct. 17; Lake Stanley, De Funiak Springs, Oct. 18].

Larva on *Aster* and allied Compositæ: specifically reported as occurring on *Aster novæ-angliæ* and *Actinomeris helianthoides.*

Extends to Labrador, the Pacific slope and Mexico.

Anthanassa frisia *Poey.* La Grange, Sept. 9 (Ds., Sleight); South Bay, Lake Okeechobee, May 1, 2 (A. M. N. H., Ds.); Miami, between Jan. 28 and Feb. 8 (Hebard); Key West (Holland).

Extends through Mexico and the Antilles to South America.

Anthanassa texana *Edw.* "Florida" (Edw.). Reported also from Texas, Nebraska and Mexico.

Variety **seminole** *Skinner.* La Grange, Sept. 9, 10 (Ds., Sleight).

Described from Georgia. The record for the typical form may refer to this variety.

Cystineura cana *Erichs* (*floridana* Strck.; *Mestra*). "Florida" (Strecker.)

Extends through the Antilles to South America.

Polygonia interrogationis *Fabr.* "East Florida," Dec., Jan. (Doubleday); St. Augustine, very rare during autumn (Johnson); Indian River (Edw.); [one specimen, Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Gainesville (Coll., Agric. Exp. Sta.)].

Larva on *Ulmus americana, Celtis occidentalis, Urtica, Bœhmeria cylindrica, Humulus lupulus* and *Tilia americana.*

Extends to Nova Scotia, Montana, Arizona and Mexico.

Euvanessa antiopa *Linn.* "Northern Florida" (Chapman); St. Augustine, very rare, saw two in 1887 (Johnson).

Larva on *Ulmus, Salix, Populus, Celtis occidentalis,* and rarely on rose bushes.

Extends to Labrador, the Pacific Coast and Central America. Occurs also in Europe and Siberia.

Vanessa atalanta *Linn.* St. Augustine, throughout the year (Johnson); Enterprise, Apr. (Castle and Laurent); Lakeland, May 6 (Ds.); South Bay, Lake Okeechobee, Apr. 29, 30, May 2 (A. M. N. H., Ds.); Lake Worth (Dyar); Miami (Laurent); [Devils Mill Hopper, Gainesville, Sept. 27; Monticello, Oct. 4].

Larva on *Humulus lupulus, Bœhmeria cylindrica, Urtica* and *Parietaria debilis.*

Occurs throughout North America, Europe, Northern Asia and Africa. It is found rarely in Cuba.

Vanessa huntera *Fabr.* "Florida," Feb., Mar. (Chapman); Jacksonville (Sloss.); St. Augustine, Oct.–Apr. (Johnson); Enterprise, Apr. (Castle and Laurent); Indian River (Palmer); Lakeland, Mar. 28, May 6, 7, Nov. 8, Punta Gorda, Nov. 17, Fort Myers, Mar. 31, La Belle, Apr. 27 (A. M. N. H., Ds.); Lake Worth (Dyar); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Lake Miceosukee, Monticello, Oct. 6 and 8; Crestview, Oct. 15 and 16; Lake Stanley, De Funiak Springs, Oct. 18; De Funiak Springs, Oct. 19; near De Funiak Springs (G. C. Fisher); Lake City (Coll. Agric. Exp. Sta., Gainesville)].

Larva on *Gnaphalium purpureum, Arctium, Helianthus* and *Antennaria.*

Extends to Nova Scotia, Vancouver, the Sierras and through Mexico and the Antilles to South America. Occurs also in the Canary Islands.

Vanessa cardui *Linn.* St. Augustine, rare during winter and spring (Johnson).

Larva on *Carduus nutans, C. lanceolatus, C. arvensis, Althæa rosea, Cnicus benedictus, Silybum marianum, Onopordon acanthium, Arctium lappa, Senecio, Helianthus, Anaphalis margaritacea* and cultivated *Artemisia.*

Cosmopolitan except Arctic regions, South America and Antilles. It occurs however in Cuba and Porto Rico.

Junonia cœnia *Hbn.* "Eastern Florida," Feb., Mar., Apr. (Scudder); "Central Florida," June 23, July 16 (Wittfeld); Pablo Beach, Sept. 27 (Ds.); Jacksonville (Sloss.); Nov. 5 (A. M. N. H.); Ortega, Sept. 6 (Sleight); St. Augustine, common throughout the year (Johnson); La Grange, Sept. 10 (Ds.); Newberry, Nov. 19, Enterprise, Nov. 9, Titusville, Nov. 8, Lakeland, Mar. 28, May 1, 7, Nov. 8, 10 (A. M. N. H., Ds.); Lake Josephine (J. and H. Comstock); Punta Gorda, Feb. (Sloss.), Nov. 11, 15, 17 (A. M. N. H., Ds.); Boca Grande, Apr. (Ds.); Fort Myers, Mar. 30, Apr. 25, 26, Nov. 16, La Belle, Apr. 27, South Bay, Lake Okeechobee, Apr. 30, May 2 (A. M. N. H., Ds.); Lake Worth (Dyar); Marco, Apr. 20, Allen River to Deep Lake, Apr. 13, Everglade, Apr. 10, Chokoloskee, Apr. 8, Miami, Nov. 15 (A. M. N. H., Ds.); Miami, common (Laurent); Key West, Sept. 18 (Ds.); [Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Fort Barrancas, Oct. 10; Pensacola, Oct. 10 and 12; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 15 and 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18; near De Funiak Springs (G. C. Fisher). Common at all the above localities.]

Larva on *Gerardia purpurea, Linaria canadensis, Ludwigia alternifolia* and *Plantago.*

Extends to Massachusetts, Alberta, California and through Mexico to Colombia. Occurs also in Cuba.

Junonia lavinia *Cram.* Marco. Apr. 18, 20, Everglade, Apr. 4, 5 (Ds.).

Occurs in Texas and through the Antilles to South America.

Anartia jatrophæ *Linn.* Fort Myers, Mar. 30, Nov. 12, 15, 16 (A. M. N. H.); Lake Worth (Dyar, Sloss.); Miami (Laurent); Key West, Sept. 17, 18 (Ds., Sleight).

Occurs in Texas and through Mexico and the Antilles into South America. A stray specimen has been reported from Boston, Mass.

Victorina steneles *Linn.* Indian River (Wittfeld).

Occurs in Texas and through Mexico and the Antilles to South America.

Eunica monima *Cram.* Lake Worth (Dyar); Biscayne Bay (Sloss.).

Extends to Arizona and through Mexico and the Antilles to South America.

Eunica tatila *H.-S.* Lake Worth (Schaus.); Biscayne Bay (Sloss.); Miami, common (Sloss., Barnes, Laurent), between Jan. 28 and Feb. 8 (Hebard), Sept. 22 (Ds.); Key West (Morrison).

Known also from the Antilles, Mexico and Colombia.

Callicore clymena *Cram.* (*Diæthria*). "Florida" (Holland).

Occurs in the Antilles, Mexico and Central America.

Timetes chiron *Fabr.* Miami (Dickerson).

Occurs in Texas and through Mexico and the Antilles into South America.

Athena peleus *Sulzer.* Indian River (Wittfeld); Avon Park (J. and H. Comstock); Allen River to Deep Lake, Apr. 12, Deep Lake, Apr. 13, Chokoloskee, Apr. 8 (A. M. N. H., Ds.); Miami, common (Laurent).

Occurs in Texas and through Mexico to South America.

Athena eleucha *Hbn.* Biscayne Bay (Sloss.); Miami, Jan. (Sloss.), between Jan. 28 and Feb. 8 (Hebard).

Occurs in Texas and the Antilles.

Basilarchia astyanax *Fabr.* [Devils Mill Hopper, Gainesville, Sept. 27; Monticello, Oct. 4.

Food plants: wild and cultivated cherry, apple, thorn, willow, poplar, birch, etc.

Extends to about the 43rd parallel of latitude and to the Mississippi Valley (Scudder).]

Basilarchia archippus *Cram.* Jacksonville, Jan. 25, Punta Gorda, Feb. (Sloss.).

Larva on *Salix nigra*, *S. sericea*, *Populus balsamifera*, *P. tremuloides*, *P. deltoides* and *P. dilatata*.

Extends to Nova Scotia, British Columbia and Texas.

Basilarchia floridensis *Strck.* Jacksonville, Sept. 7 (Ds., Sleight); St. Augustine, summer (Johnson); Gulf Hammock, Apr. (Castle and Laurent); Titusville, Nov. 8, Lakeland, May 7, Nov. 7 (A. M. N. H., Ds.); Avon Park, Apr., May (J. and H. Comstock); Punta Gorda, Feb. (Sloss.); Fort Myers, Mar. 31, South Bay, Lake Okeechobee, Apr. 30; Deep Lake, Apr. 13 (A. M. N. H., Ds.); Everglade (McD.); Biscayne Bay (Sloss.); Miami (Laurent), Nov. 5 (A. M. N. H.); [Devils Mill Hopper, Gainesville, Sept. 27; Payne Prairie, Gainesville, Oct. 2; Lake Miccosukee, Monticello, Oct. 6 and 8; Monticello, Oct. 7].

Larva on willow.

Known also from Georgia.

Chloripppe celtis *Bd. and Lec.* St. Augustine, June 26, rare (Johnson).

Larva on *Celtis.*

Extends to Montreal Island, Illinois and Mexico.

Chlorippe alicia *Edw.* Lake Josephine (J. and H. Comstock); Chokoloskee (Barnes); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30.

Food plant: *Celtis.*]

Extends to Texas.

Chlorippe clyton *Bd. and Lec.* Biscayne Bay (Sloss.).

Larva on *Celtis.*

Extends to Connecticut, Wisconsin, Kansas and Texas.

Chlorippe flora *Edw.* St. Augustine, June and July, rare (Johnson); Lake Josephine (J. and H. Comstock); Miami, Feb., Biscayne Bay (Sloss.).

Larva on *Celtis.*

Extends to Texas.

Historis odius *Fabr.* "Florida" (Dyar).

Occurs in the Antilles and South America.

Anæa portia *Fabr.* Miami, common (Laurent), Jan. (Sloss.), between Jan. 28 and Feb. 8 (Hebard).

Occurs in Georgia and the Antilles.

AGAPETIDÆ.

Cercyonis pegala *Fabr.* Apalachicola (Chapman); Jacksonville, July to Oct. (Ashmead), Sept. 17, female variety with two large eye-spots on fore wings above (Ds.); Ovieda (Meade).

Larva on "coarse wild grass."

Occurs in the South Atlantic States.

Cercyonis alope *Fabr.* St. Augustine, common in summer (Johnson).

Larva on grasses.

Extends to Maine, Canada, Kansas and Texas. Has also been recorded as occurring in California.

Enodia portlandia *Fabr.* "Florida," Feb., May, Aug., Oct. (Chapman); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Gainesville, one ♀, Apr. 14 (Coll. Agric. Exp. Sta.); Monticello, Oct. 4 and 7].

Larva on grasses.

Extends to Nova Scotia, Nebraska and Kansas. Occurs also in Mexico.

Enodia creola *Skinner.* "Florida" (Holland).

Extends to Texas and Mexico.

Satyrodes canthus *Linn.* [Lake Miceosukee, Monticello, Oct. 6 and 8.]

Neonympha gemma *Hbn.* "Florida" (Sloss.).

Larva on grasses.

Extends to West Virginia, Mexico and Central America.

Neonympha phocion *Fabr.* Pablo Beach, Sept. 5 (Sleight); St. Augustine, May and June (Johnson); Apalachicola (Chapman); Indian River (Wittfeld); La Grange, Sept. 13 (Ds.); Lakeland, May 4, 8 (A. M. N. H.); Seven Oaks (Ds.); Avon Park, Apr., May, Lake Josephine (J. and H. Comstock); Fort Myers, (McD.), Mar. 30, Apr. 2, 26, Deep Lake, Apr. 12, 13 (A. M. N. H., Ds.); Miami, common (Laurent); [common, East Gainesville, Sept. 28 and 29; Star Lake, Pensacola, Oct. 13; common, Crestview, Oct. 15 and 16; De Funiak Springs, Oct. 17].

Larva on grasses. *Panicum sanguinale* has been specifically recorded. Edwards bred it on *Dactyloctenium ægyptiacum.*

Extends to New Jersey and Texas.

The Florida examples differ from those of more northern regions in that the ocellar spots of the hind wings, beneath, are much more elongated (Davis).

Cissia eurytus *Fabr.* Ortega, Sept. 6 (Ds., Sleight); St. Augustine, Apr., May, common (Johnson); Apalachicola, Mar., Apr., May (Chapman); Haulover, Mar. 16 (Schwarz); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 9, 11 (Ds., Sleight).

Larva on grasses. Abbot figures it on *Xyris torta.*

Extends to Maine, southern Canada, Nebraska and Texas.

Cissia sosybius *Fabr.* Jacksonville, Nov. 5, Pablo Beach, Nov. 4 (Ds.); St. Augustine (Johnson); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); Titusville, Nov. 8, Lakeland, Mar. 28, May 4, 7, 8, Nov. 7 (A. M. N. H., Ds.); Lake Josephine (J. and H. Comstock); Lake Worth (Dyar); Fort Myers, rare (McD.), Apr. 24, Nov. 15, La Belle, Apr. 27, Deep Lake, Apr. 13, South Bay, Lake Okeechobee, May 2 (A. M. N. H., Ds.); [common, Agric. Exp. Sta. grounds, Gainesville, Sept. 26 and 30; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 16].

Larva on grasses.

Extends to New Jersey, through the Mississippi Valley and through Mexico to South America.

HELICONIDÆ.

Apostraphia charithonia *Linn.* Ortega, Sept. 6 (Ds., Sleight); St. Augustine, was common here prior to freeze of 1886 (Johnson); La Grange, Sept. 9 (Sleight); Titusville, Nov. 8, Lakeland, Nov. 7 (A. M. N. H., Ds.); St. Johns River (Holland); Indian River (Wittfeld, Holland); Lake Worth (Dyar, Sloss.); Useppa, Apr., May (Ds.); Fort Myers, Mar. 21, Apr. 24, La Belle, Apr. 28, Punta Rassa, Apr. 3 (A. M. N. H., Ds.); Marco, (McD.), Apr. 18 (Ds.); Deep Lake, Apr. 13, Everglade, Apr. 4, 7 (A. M. N. H., Ds.); Miami, common (Laurent), Jan. (Sloss.), Sept. 24 (Ds.), Nov. 5 (A. M. N. H.); [Agric. Exp. Sta. grounds, Gainesville, Sept. 26 and 30; Devils Mill Hopper, Gainesville, Sept. 27; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 5 and 7; Lake Miceosukee, Monticello, Oct. 8].

Larva on *Passiflora pallida.*

Extends to North Carolina and through Mexico and the Antilles to South America.

LYMNADIDÆ.

Anosia plexippus *Linn.* "Florida," Jan. 3 (Thaxter); May to Nov., rare (Chapman); Jacksonville, Jan. 25 (Sloss.); St. Augustine, common in fall (Johnson); Titusville, Nov. 8, Lakeland, May 7, 9 (A. M. N. H., Ds.); Punta Gorda, Feb. (Sloss.), Nov. 17 (A. M. N. H.); Lake Worth (Dyar); South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H., Ds.); [Jacksonville, Sept. 26; Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Monticello, Oct. 4 and 5; Lake Miceosukee, Monticello, Oct. 6; Pensacola, Oct. 12; Bayou Chico, Pensacola, Oct. 12; Crestview, Oct. 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18; near De Funiak Springs (G. C. Fisher)].

Larva on *Asclepias, Apocynum androsæmifolium* and *Acerates.*

Extends throughout North America and the Antilles to Patagonia. It has been introduced through commerce into Europe, Australia, the Malay Archipelago, the Hawaiian and some of the South Sea Islands.

Anosia berenice *Cram.* Jacksonville, Nov. 5 (Ds.); St. Augustine, common in summer (Johnson); La Grange, Sept. 7, 11 (Sleight); Titusville, Nov. 8, Lakeland, Nov. 8 (A. M. N. H.); Lake Josephine (J. and H. Comstock); Punta Gorda, Nov. 13, 15, 16, 17 (A. M. N. H., Ds.); Useppa, Apr., May, Boca Grande, Apr. (Ds.); Fort Myers, Apr. 24, Nov. 15, La Belle, Apr. 27, Citrus Center, May 3, South Bay, Lake Okeechobee, Apr.

29, May 1 (A. M. N. H., Ds.); Lake Worth (Dyar); Marco, Apr. 19, Allen River to Deep Lake, Apr. 12, Everglade, Apr. 4, Chokoloskee, Apr. 8 (A. M. N. H., Ds.); Miami, common (Laurent); Key West, Sept. 15–17 (Ds., Sleight); [Devils Mill Hopper, Gainesville, Sept. 27; Hogtown Creek, Gainesville, Oct. 1; Monticello, Oct. 4; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; common, Big Bayou, Pensacola, Oct. 14].

Larva on *Asclepias* and *Nerium*. [Also *Vincetoxicum palustre* at Lake Worth (Dyar).]

Extends to Arizona and through Mexico and the Antilles to South America.

Hebard records the variety *strigosa* Bates, which occurs in Arizona and Texas, from Miami (between Jan. 28 and Feb. 8), but it is doubtful whether this record really refers to *strigosa*.

Lycorea cleobæa *Godt.* "Florida" (Dyar).

Occurs in South America.

LIBYTHEIDÆ.

Hypatus bachmani *Kirtl.* Apalachicola (Chapman); Belleair (Sloss.); Lake Worth (Dyar).

Larva on *Celtis occidentalis*.

Extends to Ontario, Arizona and Mexico.

RIODINIDÆ.

Calephelis virginiensis virginiensis *Gray.* Pablo Beach, Sept. 5 (Sleight); St. Augustine, common in spring and summer (Johnson); La Grange, Sept. 9 (Sleight); Titusville, Nov. 8 (A. M. N. H.); Indian River (Johnson); Lakeland, May 7, 8, Nov. 9, 10 (A. M. N. H.); Avon Park (J. and H. Comstock); Charlotte Harbor (Sloss.); Punta Gorda, Feb. (Sloss.), Nov. 14 (A. M. N. H.); Fort Myers, (McD.), Mar. 30, Apr. 2 (A. M. N. H., Ds.); Miami (Laurent); [East Gainesville, Sept. 28, 29; Fisherville, Pensacola, Oct. 11; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 15, 16; De Funiak Springs, Oct. 17; Lake Stanley, De Funiak Springs, Oct. 18. Locally common at all of the above localities, and especially so at East Gainesville.]

Extends to Virginia.

[This species has generally been listed as *Calephelis cœnius* Linn. *Emesis cœneus* Linn. (*Calephelis*) is however a South American species (Stichel).

C. virginiensis Gray has a subspecies which occurs in Mexico, Central and South America (Stichel). Records of *C. cœnius* from Texas, should probably be referred to *C. nilus* Feld., or to *C. australis* Edw.

The environment for our Florida form is moist, open grassy places. It flits about, with slow flight, among the grasses and low herbaceous plants, frequently alighting after short flights. When it comes to rest, it assumes a curious (cryptic?) attitude, in which the wings are expanded and are held in the same plane with the axis of the body. The inner margins of the primaries are nearly at right angles, or very slightly less, to the axis. The secondaries are held so that the costal margins make a wide angle with the primaries, the angle being about 35°. The antennæ are projected directly in front, and are held in a plane with the wings. They may be held together in contact, or slightly expanded, the angle thus varying between 0° and 10° (maximum). The numerous individuals under observation, did not seem to show any predilection for alighting on either the upper or under surface of leaves, but had perhaps a slight preference for the vertical stems of grasses, in which case both upper and under sides of the wings might be equally exposed to the sun's rays. When at rest on the under surface of a leaf, the under side of the wings would be upward. The individuals observed gave no hint as to what their larval food plant might be.]

LYCÆNIDÆ.

Eumæus atala *Poey.* Biscayne Bay (Sloss., Schwarz); Miami, common (Laurent, Healy), Jan. (Sloss.), Sept. 25 (Ds.), Nov. 5 (A. M. N. H.); Cocoanut Grove, Sept. 14, common (Ds., Sleight); [Miami (Coll. Agric. Exp. Sta., Gainesville)].

Larva on *Zamia pumila* and *Z. integrifolia.*

Occurs in Cuba.

Atlides halesus *Cram.* Jacksonville (Sloss.); St. Augustine, April, rare (Johnson); Winter Park (Sloss.); [only one specimen, Devils Mill Hopper, Gainesville, Sept. 27; only one specimen, East Gainesville, Sept. 29; only one specimen, Hogtown Creek, Gainesville, Oct. 1; abundant, Lake Miceosukee, Monticello, Oct. 6 and 8.

Very fond of the flowers of *Eupatorium perfoliatum.* On a single flower cluster, from one to seven individuals would congregate in company with several *U. melinus* and *C. cecrops.*

A. halesus, sitting on *E. perfoliatum,* is quite conspicuous, the dark brown (nearly black) undersides being contrasted against the background of white flowers. They may, nevertheless, obtain some protection from their resemblance to dead leaves. They especially resembled the small, oval, purplish brown or black dead leaves which fell from the gum trees and caught in a vertical position among the flowers.]

Extends to New Jersey, Illinois, Southern California and through Mexico to Central America.

Eupsyche m-album *Bd. and Lec.* St. Augustine, common in summer (Johnson); Avon Park (J. and H. Comstock); Punta Gorda, Feb., Biscayne Bay (Sloss.); [one specimen, Sept. 28th and one on the 29th, East Gainesville; two specimens, Oct. 6th and one on the 8th, Lake Miceosukee, Monticello].

Extends to New Jersey, Wisconsin and through Mexico to Venezuela.

Eupsyche telea *Hewitson.* Miami, between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.).

Occurs in Mexico and South America.

Eupsyche martialis *H.-S.* Miami, Jan. (Sloss.), between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.).

Larva on *Trema micrantha.*

Occurs in Cuba.

Eupsyche hugon *Godt.* "Florida" (Dyar).

Occurs in the Antilles.

Uranotes melinus *Hbn.* St. Augustine, spring and summer, common (Johnson); Enterprise, Capron (Schwarz); La Grange, Sept. 9 (Sleight); Indian River, Mar. (Palmer); Lakeland, (McD.), May 5, 7, 8, Nov. 8 (A. M. N. H., Ds.); Punta Gorda, Feb., Charlotte Harbor (Sloss.); Fort Myers (McD.), Apr. 20, 23, 24, 25, 26, Nov. 15, 16, La Belle, Apr. 27, South Bay, Lake Okeechobee, May 2 (A. M. N. H., Ds.); Lake Worth (Dyar); Everglade, Apr. 11 (Ds.); Chokoloskee (Barnes); Miami, common (Laurent); Biscayne Bay (Sloss.); [Devils Mill Hopper, Gainesville, Sept. 27; Gainesville (Coll. Agric. Exp. Sta.); Monticello, Oct. 4, 5, 7; very common, Lake Miceosukee, Monticello, Oct. 6 and 8; Pensacola, Oct. 10; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 15 and 16; Lake Stanley, De Funiak Springs, Oct. 18; De Funiak Springs, Oct. 19].

Larva on pine and snap beans. [Also on *Lespedeza hirta.*]

Extends to Canada, Vancouver and California.

Concerning the Florida specimens of this species, Dr. McDunnough writes: "The specimens show a very prominent red patch on the under side of the secondaries, much more extended than in Hübner's figure which agrees fairly well with Texan and Californian specimens. The figure of the under side of *hyperici* given by Boisduval and LeConte corresponds better with the Florida form."

Thecla favonius *S. and A.* St. Augustine, spring and summer, common (Johnson); New Smyrna, Apr. 25; Enterprise, Apr. (Castle and Laurent); Indian River (A. M. N. H.); Lakeland (McD.), May 5, 7 (A. M. N. H., Ds.); Lake Josephine (J. and H. Comstock); Fort Myers, Apr. 1, 24, 25, South Bay, Lake Okeechobee, Apr. 30, Marco, Apr. 17, 18, 19, 20, 21 (A. M. N. H., Ds.); Marco, common (McD.); Cocoanut Grove, Apr. 2 (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on *Quercus* spp.

Extends to New Jersey and Texas.

Thecla wittfeldii *Edw.* Jacksonville, May 5 (Sloss.); Island Grove, May 13 (Seifert); Georgiana, June (Skinner); Indian River (Wittfeld).

Larva on oak.

Known only from Florida.

Several specimens from Lakeland (May 6, 8) taken by Mr. Davis, differ from the typical form by their smaller size and by the presence of a clearly marked inner white line to the transverse row of spots beneath.

Mitoura damon *Cram.* "Northern Florida" (Scudder).

Larva on *Juniperus virginiana*. *Smilax rotundifolia* recorded for this species is surely an error.

Extends to Massachusetts, Ontario, Dakota and Texas.

Mitoura acis *Dru.* Lake Worth (Sloss.); Miami (Laurent), Jan. (Sloss.), between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.).

Occurs in the Antilles.

Calycopis cecrops *Fabr.* Pablo Beach, Nov. 4, Jacksonville, Sept. 7, 28, Ortega, Sept. 6 (Ds.); St. Augustine, spring and summer, common (Johnson); La Grange, Sept. 9–13 (Ds., Sleight); Lakeland, May 5, 8 (A. M. N. H.), Nov. 8 (Ds.); Lake Worth (Dyar); Fort Myers, rare (McD.), Apr. 30 (A. M. N. H.); Useppa Is., May (Ds.); La Belle, Apr. 28, Everglade, Apr. 10 (Ds.); Miami, common (Laurent); [common, Devils Mill Hopper, Gainesville, Sept. 27; rather common, East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Payne Prairie, Gainesville, Oct. 2; Gainesville (Coll. Agric. Exp. Sta.); Monticello, Oct. 4, 5, 7; abundant, Lake Miceosukee, Monticello, Oct. 6 and 8; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14].

Extends to New Jersey and southern Indiana.

Callicista columella *Fabr.* Miami (Laurent), Nov. 5 (A. M. N. H.); Biscayne Bay (Sloss.); Key West, Sept. 16, 18, Big Pine Key, Sept. 20 (Ds.).

According to Skinner, this species extends to New York, Texas, through Mexico and the Antilles to Brazil.

Strymon titus *Fabr.* "Florida" (Hübner).

Larva on plum and wild cherry.

Extends to Canada and Arizona.

Feniseca tarquinus *Fabr.* Fernandina (Scudder); [one specimen, Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Gainesville, May 30 (J. R. Watson)].

The larva feeds on plant lice, particularly *Shizoneura tessellata,* which occurs on alder. It has also been found with *Pemphigus fraxinifolii* and *P. imbricator* which feed on ash and beech respectively.

Extends to Nova Scotia, Kansas and Texas.

Everes comyntas *Godt.* Apalachicola (Chapman).

Larva on *Lespedeza capitata, Phaseolus perennis, Meibomia marylandica, Galactia, Lathyrus* and clover. [Also on *Lespedeza hirta, Baptisia tinctoria* and *Meibomia canescens.*]

Extends to Maine, the Pacific Coast and Costa Rica.

Hemiargus hanno *Stoll.* Jacksonville, Nov. 5 (Ds.); St. Augustine, common in summer and autumn (Johnson); Titusville, Nov. 8 (A. M. N. H.); La Grange, Sept. 9–12 (Ds., Sleight); Winter Park (Sloss.); Indian River (Johnson); Lakeland, May 5, 6, 8, Nov. 8, 10 (A. M. N. H.); Punta Gorda, Feb. (Sloss.), Nov. 16 (Ds.); Charlotte Harbor (Sloss.); Fort Myers (McD.); Miami, common (Laurent), Jan. (Sloss.); Cocoanut Grove, Sept. 14 (Ds., Sleight); Biscayne Bay (Sloss.); Key West, Sept. 15, 16, Big Pine Key, Sept. 20 (Ds., Sleight); [Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Payne Prairie, Gainesville, Oct. 2; Gainesville (Coll. Agric. Exp. Sta.); Monticello, Oct. 4 and 7; Bayou Chico, Pensacola, Oct. 12.

Food plant: *Phaseolus lathyroides.*]

Extends through Mexico and the Antilles to South America.

Hemiargus ammon *Lucas.* Indian River (Edwards); La Grange, Sept. 11 (Ds.); Lakeland, May 7 (A. M. N. H.); Lake Worth (Sloss., Dyar); Useppa Is., May (Ds.); Punta Rassa, Apr. 3, Marco, Apr. 21, Everglade, Apr. 15 (A. M. N. H.); Miami, Jan. (Sloss.), Sept. 3 (Sleight), Nov. 5 (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on *Guilandina bonducella* and *Pithecolobium guadalupensis.*

Extends through the Antilles and tropical America.

Brephidium isophthalma *H.-S.* Indian River (A. M. N. H.); Punta Gorda, Feb. (Sloss.); Boca Grande, Apr. (Ds.); Marco, Apr. 20, 21, Everglade, Apr. 5, 6, 7, 9 (A. M. N. H., Ds., McD.); Key West, Sept. 18 (Sleight).

Extends to Georgia and through the Antilles. This species was very common in the middle of the salt marsh, at Everglade, wherever patches of a peculiar fleshy-leaved plant grew.

Leptotes theonus *Lucas.* Indian River (Edwards); Punta Gorda, Feb., Charlotte Harbor (Sloss.); Useppa Is., May (Ds.); Punta Rassa, Apr. 3, Chokoloskee, Apr. 8 (A. M. N. H., Ds., McD.); Miami, common (Laurent), Jan. (Sloss.), Nov. 5 (A. M. N. H.); Biscayne Bay (Sloss.); Key Largo, Nov. 6 (A. M. N. H.); Key West, Sept. 15 (Sleight).

Occurs in Cuba.

According to Holland it is found throughout the "Gulf States and hot lands of the New World."

HESPERIIDÆ.

Phocides batabano *Lefeb.* (*Erycides*). Indian River (Worthington); Punta Gorda, Feb. (Dyar); Charlotte Harbor (Sloss.); Useppa, Apr., May, Boca Grande, Apr. (Ds.); Lake Worth (Dyar); Marco Island, May (Worthington); Everglade, Apr. 5, 6 (A. M. N. H., McD.), Apr. 5, 7 (Ds.); Chokoloskee, Apr. 8 (A. M. N. H.); Dade Co. (Dyar); Miami, Jan. (Sloss.); [Punta Rosa (Johnson].

Larva on *Rhizophora mangle.*

This species has, so far, been recorded only from Florida and Cuba.

Acolastus amyntas *Fabr.* (*Erycides*). Miami, common (Laurent, Skinner), Jan. (Sloss.), between Jan. 28 and Feb. 8 (Hebard), Nov. 5 (A. M. N. H.); Biscayne Bay (Sloss.); Key West, Jan. (Skinner), Sept. 18 (Sleight).

Larva on *Piscidia erythrina.*

Extends to Arizona, Mexico, Central America, and through the Antilles.

Eudamus proteus *Linn.* Jacksonville, Nov. 3 (A. M. N. H.), Sept. 7, Nov. 3, 5 (Ds.); Pablo Beach, Nov. 4 (A. M. N. H.); Apalachicola (Chapman); De Land Landing, St. Johns River, larvæ, Feb. 21 (Chittenden); Archer, larvæ, Nov. 4 (Neal); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); Enterprise (Chittenden); Titusville, Nov. 8 (A. M. N. H.); Indian River, end of Mar., three broods in Florida (Palmer); Lakeville, larvæ, Dec. 2 (Babbitt); Rockledge (Chittenden); Lakeland, Nov. 7, Punta Gorda, Nov. 11, 17 (A. M. N. H.); Charlotte Harbor (Sloss.); South Bay, Lake Okeechobee, May 2 (A. M. N. H.); Fort Myers, Apr. 25, Mar. 31, Nov. 12 (A. M. N. H.), Mar. 31 (Ds.); Miami, common (Laurent), Nov. 5 (A. M. N. H.); Biscayne Bay (Sloss.); Florida Keys (Maynard, Palmer); [Devils Mill Hopper, Gainesville, Sept. 27; common, East

Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; De Funiak Springs, Oct. 17; Lake Stanley, De Funiak Springs, Oct. 18; St. Augustine (Johnson)].

Larva on various species of Leguminosæ, as *Wisteria frutescens, Desmodium viridiflorum, D. canescens, Phaseolus perrennis* and *Clitoria mariana.*

Extends along the Atlantic coast to Connecticut (very rarely to Canada), along the Gulf to Texas and through Mexico and the Antilles to Argentina.

Epargyreus tityrus *Fabr.* St. Johns River, Indian River (Palmer); La Grange, Sept. 10, 11 (Ds., Sleight); Lakeland, Mar. 28, Nov. 8, Fort Myers, Mar. 31, Deep Lake, Apr. 13 (A. M. N. H., Ds.); Miami, Jan. (Skinner); [Devils Mill Hopper, Gainesville, Sept. 27; Lake Miceosukee, Monticello, Oct. 6].

Larva on various species of Leguminosæ, as, *Amorpha fructicosa, Robinia pseudacacia, R viscosa, R. hispida, R. neomexicana* (in southern California), *Wisteria frutescens, Lepedeza capitata, Lathyrus palustris, Apios tuberosa, Desmodium marylandicum, D. canadense, D. nudiflorum, Falcata comosa* and *Gleditsia.*

Extends from Vancouver, Quebec and Maine through Mexico and Central America to Ecuador and the Upper Amazons. Occurs also in the Antilles.

Epargyreus zestos *Hbn.* (*Rhabdoides*). Sanford (Skinner); Marco Island, May (Worthington); Miami (Laurent), between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.); Key West (Skinner).

[Occurs in the Antilles and South America.]

Achlarus lycidas *S. and A.* [One old specimen, Devils Mill Hopper, Gainesville, Sept. 27; one old specimen, Monticello, Oct. 5.

Food plant: *Meibomia paniculata.*

Occurs in the Atlantic States and the Mississippi Valley.]

Rhabdoides cellus *Bd. and Lec.* Tallahassee, Apr. 17 (Maynard); Biscayne Bay (Sloss.).

Larva on *Breweria aquatica.*

Extends to West Virginia, the Pacific Slope and Mexico.

Cocceius pylades *Scudd.* (*Thorybes*). Apalachicola (Chapman); St. Johns River, St. Augustine (Palmer); Island Grove, Apr. 15, 23 (A. M. N. H.); La Grange, Sept. 9 (Ds., Sleight); Indian River (Palmer); Enterprise, Apr. (Castle and Laurent); South Bay, Lake Okeechobee, May 2 (A. M. N. H.); Fort Myers, Mar. 31 (Ds.).

Larva on many species of Leguminosæ, as *Trifolium pratense, T. repens, Lespedeza capitata* and *L. hirta.* It was also raised on *Desmodium dillenii.*

Extends to Maine, California and the Mackenzie region.

Thorybes daunus *Cram.* (*bathyllus S. and A.*). La Grange, Sept. 10 (Ds.); Miami (Laurent); Sept. 24 (Ds.); Biscayne Bay (Sloss.); [one specimen, Monticello, Oct. 5; one specimen, De Funiak Springs, Oct. 17; one specimen, Lake Stanley, De Funiak Springs, Oct. 18].

Larva on Leguminosæ, as, *Rhynchosia tomentosa, Tephrosia ambigua, Centrosema virginianum* [and *Lespedeza capitata*].

Extends to Massachusetts, Wisconsin, Arizona and through Mexico to Central America.

Heliopetes syrichtus *Fabr.* (*Hesperia*). Key West (Skinner).

[Food plant: *Sida retusa.*]

Extends to (?) Colorado, and through Mexico to Paraguay. [Occurs also in the Antilles.]

Pyrgus tessellata *Scudd.* (*Hesperia*). Jacksonville, Sept. 7, La Grange, Sept. 10, Lakeland, Nov. 8 (Ds.); Key West, Sept. 16–18 (Ds., Sleight); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 8; Pensacola, Oct. 10 and 12; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 16; De Funiak Springs, Oct. 17 and 19].

Larva on *Althœa, Abutilon* and *Sida.*

Occurs throughout Florida and to New York, Alberta, California and through Mexico to Nicaragua. The records from western localities may refer to a small form named *occidentalis* by Skinner.

Staphylus hayhurstii *Edw.* (*Pholisora*). La Grange, Sept. 9, 10 (Ds., Sleight); Useppa, Apr., May (Ds.); Lake Worth (Dyar); Marco, Apr. 30 (A. M. N. H.); Miami, common (Laurent), Jan. (Sloss.), Nov. 5 (A. M. N. H.); Biscayne Bay (Sloss.); [East Gainesville, Sept. 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30].

Larva on *Alternanthera.*

Extends to southern Pennsylvania, Kansas and New Mexico.

Melanthus brunnea *H.-S.* Florida Keys (Dyar).

Occurs also in Cuba.

Thanaos somnus *Lint.* Indian River (Lintner, A. M. N. H.); "Southern Florida" (Holland); [Marco Island, Feb., Island Grove, Mch. 19–Apr. 5 (Seifert). Records given by Dr. Skinner in "Studies in the Genus Thanaos" (Trans. Am. Ent. Soc. XL, 1914, p. 202): Georgiana, Indian River; Ormond, Mch. 27; Osprey, Mch. 11.

Known only from Georgia and Florida.

This is probably a subspecies of the following one.]

Thanaos brizo *Bd. and Lec.* Haulover (Schwarz). [This record should perhaps be referred to the preceding form.]

Larva on *Quercus ilicifolia* and *Galactia glabella.*

Extends to Nova Scotia, Athabasca and the Pacific Coast.

Thanaos icelus *Lint.* "Florida" (Edwards).

Larva on *Populus* and *Salix.*

Extends to Nova Scotia, Winnipeg, British Columbia and Arizona.

Thanaos terentius *Scudd. and Burg.* (*nævius* Lint.). Apalachicola (Thaxter); Lakeland, May 5, 7 (A. M. N. H.); "Pablo Beach, Sept. 27 (Ds.); Jacksonville, Sept. 7, 9 (Ds., Sleight); Enterprise, Apr. (Castle and Laurent); Indian River (Lintner, A. M. N. H.); Fort Myers (McD.), Apr. 23 (Ds.), Apr. 25, 30 (A. M. N. H.); Marco (McD.). Laurent has also reported it as common at Miami but in this instance the identification was somewhat doubtful." [Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Big Bayou, Pensacola, Oct. 14; Useppa Is., Apr. 19 (Ds.). Common in the Pensacola region. The preceding records in quotation marks, Mr. Grosbeck had placed under *T. nævius* Lint.

Extends northward along the Atlantic coast to Massachusetts.]

Thanaos juvenalis *Fabr.* St. Johns River (Norton); Apalachicola (Chapman, Thaxter); Crescent City (Hubbard); Okahumpka (Maynard); Fort Myers (McD.); Lakeland, May 8, South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.); Florida Keys (Maynard); Biscayne Bay (Slosson).

Larva on *Quercus ilicifolia, Q. alba, Apios tuberosa* and *Lathyrus.* It has also been reared on *Corylus.*

[Extends to Canada and the Mississippi Valley.]

Thanaos horatius *Scudd and Burg.* (*petronius* Lint.). St. Johns River, mid August, Florida Keys, late July (Palmer); "Jacksonville, Sept. 7 (Sleight), Nov. 5 (Ds.); La Grange, Sept. 10 (Ds.); Indian River (Lintner); Lakeland, May 6, 7, 8, Nov. 9 (A. M. N. H., Ds.); Useppa (Ds.); La Belle, Apr. 27, Fort Myers, Mar. 30, Apr. 24, 25, Marco, Apr. 20 (Ds.); Miami, common (Laurent); Biscayne Bay (Sloss.)"; [East Gainesville, Sept. 28; Payne Prairie, Gainesville, Oct. 2; Lake Miceosukee, Monticello, Oct. 8; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14. Common in the Pensacola region. The preceding records in quotation marks, Mr. Grossbeck had placed under *T. petronius* Lint.

Larva on *Quercus.*

Extends to Massachusetts, Texas and Arizona.

This species, together with *T. terentius* Scudd. and Burg., were often seen feeding on the flowers of *Helianthus heterophyllus* at Fisherville, Pensacola. They seemed to be especially fond of the old blackish brown flower-heads which had lost all or nearly all of their petals and when feeding on these were quite inconspicuous.]

Thanaos funeralis *Scudd. and Burg.* [Three males, Bayou Chico, Pensacola, Oct. 12; one male, Big Bayou, Pensacola, Oct. 14.

These seem to be the first records for this species from Florida. It is recorded from Southern California, Utah, Colorado, Arizona, New Mexico, Texas, Mexico, Central America to Colombia.]

Thanaos platus *Scudd. and Burg.* "Florida" (Scudder and Burgess).

Known only by the types. [This species is probably incorrectly placed under this genus.]

Ancyloxypha numitor *Fabr.* Enterprise, Apr. (Castle and Laurent); Lakeland, May 7 (A. M. N. H.), Nov. 7 (Ds.); Fort Myers, Apr. 26 (A. M. N. H.); South Bay, Lake Okeechobee, Apr. 30 (Ds.); May 2 (A. M. N. H.); Miami, common (Laurent); Biscayne Bay (Sloss.); [East Gainesville, Sept. 28 and 29; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 5 and 7; Lake Miceosukee, Monticello, Oct. 6 and 8].

Larva on grasses.

Extends to Maine, Quebec, Texas and the Rocky Mountains.

Hylephila phylæus *Drury.* Jacksonville, Nov. 3, 5 (A. M. N. H.); Pablo Beach, Sept. 5 (Sleight); Apalachicola (Chapman); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 10, 12 (Ds.); Titusville, Nov. 8 (A. M. N. H.); Indian River (A. M. N. H.), Mar. (Palmer); Lakeland, May 5 (A. M. N. H.), May 7, Nov. 8 (Ds.); Punta Gorda, Feb. (Sloss.); Nov. 6, 16, 17 (A. M. N. H., Ds.); Fort Myers, Apr. 2, 25, 26, Nov. 14, 15 (A. M. N. H., Ds., McD.); Chokoloskee (Barnes); Miami, common (Laurent), Sept. 23 (Ds.); Key West, Sept. 16–18 (Ds., Sleight); [East Gainesville, Sept. 28; Hogtown Creek, Gainesville, Oct. 1; Monticello, Oct. 4 and 5, Lake Miceosukee, Monticello, Oct. 8; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 15; Lake Stanley, De Funiak Springs, Oct. 18; De Funiak Springs, Oct. 19; Eau Gallie, Indian River, Apr. 24 (E. L. Bell)].

Larva on grasses.

Extends to Connecticut, southern California, and through Mexico and the Antilles to Patagonia.

Atalopedes campestris *Bd.* (*Hylephila*). Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); Lakeland, May 7 (A. M. N. H.), Nov. 7, 8 (Ds.); Punta Gorda, Nov. 15, 16, 17 (A. M. N. H., Ds.); Charlotte Harbor (Sloss.); Fort Myers, Apr. 24, 25, South Bay, Lake Okeechobee, May 2, La Belle, Apr. 27 (A. M. N. H., Ds.); Boca Grande, Apr. (Ds.); [East Gainesville, Sept. 28; Monticello, Oct. 5; Pensacola, Oct. 10 and 12; Bayou Chico, Pensacola, Oct. 12. One male specimen attracted by the hotel lights, was taken on a screen door along with some moths, on the evening of Sept. 30th, at Gainesville. Eau Gallie, Indian River, Apr. 24 (E. L. Bell)].

Larva on *Cynodon dactylon* and other grasses.

Extends to New York, Dakota, California and Central America.

Thymelicus baracoa *Lucas* (*Polites*). Ortega, Sept. 6, not rare (Ds., Sleight); Biscayne Bay (Sloss.); [East Gainesville, Sept. 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Monticello, Oct. 4, 5, 7].

Occurs also in Georgia and the Antilles.

Thymelicus brettus *Bd. and Lec.* Jacksonville, Sept. 28, Nov. 5 (Ds.); Apalachicola, Aug. 15 (Chapman); Newberry, Nov. 13 (Ds.); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 9, 10 (Ds., Sleight); Indian River (A. M. N. H.), and Mar. (Palmer); Lakeland, May 6, 8, Nov. 8 (A. M. N. H.), March 28, May 4, 5, 6, 8, Nov. 7, 8 (Ds.); Punta Gorda, Feb (Sloss.), Sept. 17 (Ds.); Nov. 13, 16 (A. M. N. H.); La Belle, Nov. 13, 14., South Bay, Lake Okeechobee, May 2 (A. M. N. H.); Useppa, Apr. (Ds.); Fort Myers, Mar. 30, 31, Apr. 1, 2, 3, 7, 23, 24, 25, 26 (A. M. N. H., Ds.); Miami, common (Laurent); [East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Sept. 30; Hogtown Creek, Gainesville, Oct. 1; Payne Prairie, Gainesville, Oct. 2; Monticello, Oct. 4, 5, 7; Lake Miceosukee, Monticello, Oct. 6 and 8; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18. Common everywhere.]

Larva on *Paspalum setaceum* and *P. ciliatifolium.*

Extends to Connecticut, Wisconsin, Central America and the Antilles. It is also listed from California by Woodworth.

Thymelicus cernes *Bd. and Lec.* Pablo Beach, Sept. 27 (Ds.); Lakeland, Mar. 28, May 5, 7, Nov. 10 (A. M. N. H., Ds.); Punta Gorda, Nov. 15 (Ds.); Fort Myers (McD.), Apr. 23 (A. M. N. H.); South Bay, Lake Okeechobee, May 2 (A. M. N. H.); Miami (Laurent); [one specimen, Monticello, Oct. 4; one specimen, Fisherville, Pensacola, Oct. 11; one specimen, Lake Stanley, De Funiak Springs, Oct. 18].

Larva on *Panicum crus-galli, Triticum repens, Phleum pratense* and other grasses.

Extends to Canada, British Columbia, Utah and Texas.

Catia drury *Latr.* (*otho* S. and A.; *Thymelicus*). Jacksonville, Sept. 7

(Ds.); Gulf Hammock, Apr. (Castle and Laurent); Indian River (A. M. N. H.); Lakeland, May 5 (Ds.); Biscayne Bay (Sloss.); Key West, Sept. 16, 17 (Ds.); [Gainesville (Coll. Agric. Exp. Sta.); one specimen, Fisherville, Pensacola, Oct. 11].

Variety **egeremet** *Scudd.* Indian River (A. M. N. H.); [one specimen, Devils Mill Hopper, Gainesville, Sept. 27; one specimen, Lake Miceosukee, Monticello, Oct. 6; Eau Gallie, Indian River, Apr. 24 (E. L. Bell)].

Larva on grasses.

Extends to Maine, Montreal, Wisconsin, Arizona and Central America.

Erynnis metea *Scudd.* " Florida " (Skinner).

Larva on grasses.

Extends to New Hampshire, Colorado and Texas.

Erynnis attalus *Edw.* Lakeland, May 6, 8, Nov. 8, Fort Myers, Mar. 30, Allen River to Deep Lake, Apr. 12, 14 (Ds.); Miami (Laurent); Biscayne Bay (Sloss.); [Bayou Chico, Pensacola, Oct. 12; Crestview, Oct. 16; common, Lake Stanley, De Funiak Springs, Oct. 18; common, De Funiak Springs, Oct. 19].

Larva on grasses.

Extends to Massachusetts, Iowa and Texas.

Erynnis leonardus *Harr.* (*Anthomaster*). Indian River (Edwards); " Northeastern Florida " (Scudder).

Larva on grasses.

Extends to Maine, Montreal, Iowa and Kansas but not including the region along the Gulf.

Erynnis meskei *Edw.* (*Anthomaster*). Indian River (A. M. N. H., B'klyn. Mus.).

Occurs in Texas and Florida.

Ochlodes sassacus *Harr.* (*Erynnis*). Jacksonville (Sloss.).

Larva on *Panicum sanguinale* and other grasses.

Extends to Canada and Colorado.

Lerema accius *S. and A.* Ortega, Sept. 6 (Sleight); Apalachicola (Chapman); Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 9–12 (Ds.); Indian River (A. M. N. H., Wittfeld); Lakeland, May 6, Useppa, Apr. 14, May, Boca Grande, Apr. (Ds.); Lake Worth (Dyar); Florida Keys (Palmer); Key West, Sept. 18 (Sleight); [Devils Mill Hopper, Gainesville, Sept. 27; common, East Gainesville, Sept. 28; common, Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Monticello, Oct. 5 and 7; common, Lake Miceosukee, Monticello, Oct. 6 and 8; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Crestview, Oct. 15 and 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18].

Larva on *Erianthus alopecuroides* and *Zea mays.*

Extends along the Atlantic Coast to Connecticut, along the Gulf to Texas, along the Mississippi River to Illinois, and southward to Central America.

Thespieus macareus *H.-S.* Marco Island (Skinner).

Extends through Mexico to South America.

Stomyles textor *Hbn.* (*Amblyscirtes*). Apalachicola (Chapman); [one specimen, Devils Mill Hopper, Gainesville, Sept. 27].

Extends to North Carolina, Louisiana and Texas.

Stomyles celia *Skinner* (*Amblyscirtes*). "Florida" (Skinner).

Known also from Texas.

Stomyles fusca *G. and R.* (*Euphyes*). Gulf Hammock, Apr. (Castle and Laurent); La Grange, Sept. 9, Lakeland, May 8 (Ds.); Punta Gorda, Feb. (Sloss.); Fort Myers (McD., Mattes); [East Gainesville, Sept. 28 and 29; Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18].

Extends along the Atlantic Coast to New York.

Amblyscirtes vialis *Edw.* Apalachicola (Chapman).

Larva on *Avena striata, Poa pratensis* and other grasses.

Extends to Montreal, Texas, Nevada and British Columbia.

Amblyscirtes meridionalis *Dyar.* "Florida" (Dyar).

Known only from Georgia and Florida.

Paratrytone howardi *Skinner* (*Phycanassa*). "Florida" (Skinner).

Known only from Florida.

Phycanassa viator *Edw.* "Florida" (Scudder).

Extends to Toronto, Nebraska and Texas.

Calpodes ethlius *Cram.* Miami, Jan., Biscayne Bay (Sloss.); [eggs and larvæ in all stages on *Canna*, Gainesville, Oct. 3; larvæ in various stages on *Canna*, Pensacola, Oct. 10].

Larva on *Canna flaccida* and *C. indica.*

Extends as a migrant to Long Island, where it is sometimes found breeding; to Missouri, Texas and through Mexico and the Antilles to Argentina.

Lerodea loammi *Whitney* (*Lerema*). Jacksonville, Mar. 22, 23 (Whitney); Upper St. Johns River (Orange Co.) (Edwards, Bates); Fort Myers, Mar. 30 (Ds.); Miami (Laurent).

Extends to North Carolina.

Lerodea maculata *Edw.* (*Oligoria*). Jacksonville, Sept. 7 (Ds., Sleight); Apalachicola (Chapman); Gulf Hammock, Apr. (Castle and Laurent) La Grange, Sept. 10 (Ds.); Indian River (A. M. N. H.), end of

Mar. (Palmer); Brevard Co. (Wittfeld); Lakeland, May 7 (A. M. N. H.); Punta Gorda, Feb. (Sloss.); Fort Myers, Apr. 2, 24 (Ds., McD.); Miami, common (Laurent); [rather common, East Gainesville, Sept. 28 and 29; Star Lake, Pensacola, Oct. 13].

The larva has been described but the food plant is apparently unrecorded.

Extends to Massachusetts and Texas.

Lerodea eufala *Edw.* (*floridæ* Mab.; *Euphyes*). Apalachicola (Chapman); Indian River (A. M. N. H.); La Grange, Sept. 9 (Sleight); Lakeland, Nov. 8 (Ds.); Fort Myers (McD.), Mar. 30 (A. M. N. H.); Miami, Nov. 5 (A. M. N. H.); Big Pine Key, Sept. 19, Key West, Sept. 9 (Ds.); [East Gainesville, Sept. 28; Monticello, Oct. 5 and 7; common, Bayou Chico, Pensacola, Oct. 12; common, Star Lake, Pensacola, Oct. 13; abundant, Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; Lake Stanley, De Funiak Springs, Oct. 18; De Funiak Springs, Oct. 19].

Extends to Texas and Central America. Occurs also in the Antilles.

Lerodea osyka *Edw.* (*Euphyes*). Lake Worth (Dyar).

Extends to Indiana, Texas and Mexico.

Euphyes metacomet *Harr.* Indian River (Skinner); [one male, Hogtown Creek, Gainesville, Oct. 1; two males, Bayou Chico, Pensacola, Oct. 14].

Extends to New England and the Pacific Coast.

Limochroes arpa *Bd. and Lec.* Apalachicola (Chapman); Indian River (A. M. N. H.); Punta Gorda, Feb. (Sloss.), Nov. 13 (Ds.); [East Gainesville, Sept. 28 and 29; Eau Gallie, Indian River, Apr. 24 (E. L. Bell)].

Larva on saw palmetto.

Extends westward along the Gulf.

Limochroes byssus *Edw.* Indian River (A. M. N. H., W. H. Edwards); Biscayne Bay (Sloss.).

Extends to Texas.

Limochroes palatka *Edw.* Apalachicolo (Chapman); Indian River (A. M. N. H., Holland); Avon Park (J. and H. Comstock); Allen River to Deep Lake, Apr. 12 (A. M. N. H.); Miami (Laurent); [Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13].

Larva on *Cladium effusum.*

Extends westward along the Gulf and has also been reported from Nebraska.

Limochroes yehl *Skinner.* "Florida" (Holland).

Extends to Tennessee.

Limochroes streckeri *Skinner* (*Phycanassa*). "Florida" (Skinner).

Known only from Florida.

Prenes ocola *Edw.* Jacksonville, Sept. 7 (Ds.), Nov. 5 (A. M. N. H., Ds.); Newberry, Nov. 18 (Ds.); Indian River (A. M. N. H.); Lakeland, Nov. 8, Punta Gorda, Nov. 15, 16, 17 (A. M. N. H., Ds.); Fort Myers (McD.); La Belle, Nov. 14, Everglade, Apr. 5, Miami, Nov. 5 (A. M. N. H.); [East Gainesville, Sept. 28 and 29; Lake Miceosukee, Monticello, Oct. 8; Fisherville, Pensacola, Oct. 11; abundant, Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Lake Stanley, De Funiak Springs, Oct. 18].

Extends to Staten Island, Nebraska, and Mexico to South America.

Prenes nero *Fabr.* Marco Island (Skinner).

Extends through Mexico and the Antilles to Brazil.

Prenes panoquin *Scudd.* Ortega, Nov. 3 (A. M. N. H.); Apalachicola (Chapman); Titusville, Nov. 8, Indian River, Lakeland, May 8 (A. M. N. H.); Punta Gorda, Nov. 6, 15, 16, 17, Marco, Apr. 17, Everglade, Apr. 5, 6, 9 (A. M. N. H., Ds., McD.); [one male, Big Bayou, Pensacola, Oct. 14].

Extends along the Atlantic coast to New Jersey.

Prenes panoquinoides *Skinner.* Punta Gorda, Nov. 11 (A. M. N. H.); Marco, Apr. 20, 21 (Ds.); Key West (*Skinner*), Sept. 19 (Ds.).

Extends to Texas.

Anatrytone logan *Edw.* (*delaware* Edw.). [*A. vitellius* Fabr. (Dyar 566) is a tropical species.] Apalachicola (Chapman); Jacksonville, Sept. 27 (Ds.); Enterprise, Apr. (Castle and Laurent); Allen River to Deep Lake, Apr. 12 (A. M. N. H., Ds.); Miami (Laurent); Biscayne Bay (Sloss.).

Larva on *Erianthus alopecuroides.*

Extends to southern New England.

Anatrytone arogos *Bd. and Lec.* (*Phycanassa*). "Florida" (Dyar); La Grange, Sept. 12 (Ds.); [Miami, Fla., August (Coll. A. M. N. H.)].

Extends to New Jersey and Nebraska.

Megathymus yuccæ *Bd. and Lec.* Avon Park (J. and H. Comstock); Lake Worth (Sloss.); [Gulfport (R. Ludwig)].

Larva in stems and roots of *Yucca aloifolia, Y. gloriosa,* and *Y. filamentosa.*

Extends to South Carolina. This is the range of the typical form only; a subspecies occurs from Texas to Colorado and Arizona.

Megathymus cofaqui *Strck.* St. Augustine (Johnson); Boca Grande (Ds.).

Known only from Florida and Georgia. It has been recorded from Colorado, but erroneously.

The male of this species has, until now, remained undiscovered and, as it differs sufficiently from the female to be taken for another species, I append the following description of it.

♂.— Expanse, 60 mm. Head and upper side of palpi brown, the former with some white scales; palpi beneath white. Antennal shaft ringed with white and brown, the tip brown above, hoary beneath. Body brown with long silken yellow hairs at the base of the abdomen. Upper surface of wings umber-brown, tinged at base and inner margin with yellow. Primaries with a sub-apical rectangular whitish spot between veins R_3 and M_1, finely divided by the two intervening veins, R_4 and R_5. A large squarish spot, bifid basally, occupies the end of the cell; this is yellow except on the anterior part where it is whitish. External to the subapical spot and between veins M_1 and M_3 are two smaller yellowish-white spots rather widely separated from each other. Beginning at vein M_3 is a very broad yellow subterminal band which extends to the anal vein; this is greatly constricted immediately below Cu_2 on the internal side and does not join with the spot in the cell as it does so broadly in the female. In this respect the band is similar to that of *streckeri* and *aryxna*. Secondaries with a broad yellow unbroken band to the outer margin; a vague yellowish spot which tends to join with the marginal band is present on vein M_2. Beneath, primaries as above but paler, and the subterminal band broader; just preceding the spot in the cell is a white patch divided by the brown veins. Secondaries hoary except on basal and costal regions where they are brown; two conspicuous and defined pure white spots, well separated, are present below the subcostal vein. There is a subterminal row of about four rather diffuse brown crescents, indistinctly pupilled with white, and a larger more diffuse brown blotch on the disk of the wing; this latter is somewhat connected with the crescents by vague irregular markings between the last cubital and first anal vein.

The chief differences between this sex and the female is in the subterminal band referred to, in the absence of the double row of large yellow spots on the secondaries above and its replacement by a single marginal band, and on the under side of the wings in the reduction in the size of the spots. In appearance it approaches more nearly *streckeri* and might, at first glance, be taken for an extreme form of the subspecies *texana*. It differs from *streckeri*, however, in the absence of the long hair on the primaries beneath. The presence of the long hair on the upper surface of the secondaries places *cofaqui* in group III of Barnes and McDunnough's Revision of the Megathymidæ. The allotype is from Boca Grande and is in the collection of Mr. Davis.

SPHINGIDÆ.

Herse cingulata *Fabr.* (*Phlegethontius*). Gulf Hammock, Apr. (Castle and Laurent); Indian River (A. M. N. H.); Punta Gorda, Feb., larva, Lake Worth (Sloss.); Fort Myers, Apr. 2, 22, 23, Chokoloskee, Apr. 8 (Ds.); Biscayne Bay (Sloss.); [near De Funiak Springs (G. C. Fisher); St. Augustine (Johnson)].

Variety **decolorata** *Hy. Edw.* Indian River (A. M. N. H.).

Larva on *Ipomœa* and *Convolvulus* species.

Extends to Canada (as a straggler), South Dakota, California, through Mexico and the Antilles to Argentina. Occurs also in the Galapagos and Hawaiian Islands.

Cocytius antæus medor *Stoll.* Palm Beach, Feb., larva, Lake Worth (Dyar); Fort Myers (McD.); Biscayne Bay (Sloss.); Key West (Grote).

Larva on *Anona laurifolia.*

Has been reported from as far north as Chicago; southward it extends through Mexico to Southern Brazil. The typical form is confined to the Antilles.

Protoparce sexta *Johan.* (*Phlegethontius*). Lake Worth (Sloss.); Fort Myers, Mar. 30, 31, Apr. 22 (A. M. N. H., Ds.); Everglade, Apr. 13 (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on Solanaceæ. Dyar bred it on tomato in Florida.

Extends to New York, the Pacific, and through Mexico to Honduras. A race of this species is confined to the West Indies and two others to Central and South America.

Protoparce quinquemaculata *Haw.* (*Phlegethontius*). Gulf Hammock, Apr. (Castle and Laurent); Punta Gorda, Feb., larva, (Sloss.); Everglade (McD.).

Larva on *Solanum, Nicotiana* and *Datura.* Mrs. Slosson found it on tomato in Florida.

Extends to Canada, the Pacific and Mexico. A race occurs in the Hawaiian Islands.

Protoparce rustica *Fabr.* (*Phlegethontius*). Has apparently not yet been reported from Florida though it must surely occur there.

The typical form ranges from New York and Ohio, through Mexico and the Antilles to Buenos Ayres.

Subspecies occur in the West Indian and Galapagos islands.

The larva feeds on *Chionanthus, Jasminium* and *Bignonia.*

Protoparce brontes cubensis *Grt.* (*Diludia*). Indian River (A. M.

N. H.); Chokoloskee (Barnes); Miami (Rothschild and Jordan); South Florida (Dyar).

Extends through the Bahamas and West Indian Islands. The typical form is confined to Jamaica.

Dolba hylæus *Dru.* Jacksonville, Enterprise, Indian River, Rockledge, Lake Worth (Sloss.); [St. Augustine (Johnson)].

Larva on *Comptonia asplenifolia, Asimia triloba, Ilex glabra* and *I. verticilata.*

Extends to Canada and Missouri.

Ceratomia undulosa *Wlk.* South Bay, Lake Okeechobee, May 1 (Ds.).

Larva on *Fraxinus, Ligustrum, Syringa* and *Robinia.*

Extends to Canada and Dakota.

Ceratomia catalpæ *Bd.* Tallahasse, Indian River (A. M. N. H.); [near De Funiak Springs (G. C. Fisher)].

Larva on *Catalpa.*

Extends to New York and to the Mississippi.

Isoparce cupressi *Bd.* (*Sphinx*). Enterprise (Sloss.).

Larva on *Cupressus thyoides.*

Known from Georgia and Florida only.

Atreus plebeja *Fabr.* (*Sphinx*). Jacksonville, Enterprise (Sloss.); Sanford, June (Rothschild and Jordan); Fort Myers, Apr. 22 (A. M. N. H.).

Larva on *Syringa, Tecoma radicans, Bignonia* and *Passiflora.*

Extends to Canada, Missouri and Texas.

Lapara coniferarum *S. and A.* Jacksonville, Enterprise (Sloss.); Sanford, June (Rothschild and Jordan); Punta Gorda, Feb., Lake Worth (Sloss.); [one nearly full grown larva taken on *Pinus virginiana*? at Big Bayou, Pensacola, Oct. 14; Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Pinus palustris.*

Extends along the Atlantic coast to Canada. [Also to the Mississippi Basin (Rothschild and Jordan).]

Lapara bombycoides *Wlk.* "Florida" (Rothschild and Jordan).

Larva on *Pinus strobus* and other species of *Pinus.*

Extends along the Atlantic coast to Canada. [Also to the Mississippi Basin (Rothschild and Jordan).]

Lapara halicarniæ *Strck.* (*Exedrium*). Florida (Strecker). Known only by the type.

Protambulyx strigilis *Linn.* [Miami, Feb. 2 (Hebard)]. The aberration *rubripennis* Butl. has been doubtfully recorded from Palm Beach.

Larva on *Anacardium, Spondia, Erythroxylon* and *Comocladia.*

Extends through the Antilles and Mexico to southern Brazil.

Protambulyx carteri *R. and J.* Biscayne Bay (Sloss.).

Occurs in the Bahamas.

Calasymbolus excæcatus *S. and A.* (*Paonias*). Florida (Rothschild and Jordan).

Larva on *Prunus, Spiræa* and other Rosaceæ, *Wisteria, Ulmus, Quercus, Betula, Salix, Populus, Corylus, Carpinus,* etc. (For complete list of food plants see Ent. Am., I, p. 196.)

Extends to Canada and Colorado.

Cressonia juglandis *S. and A.* Green Cove Springs (on St. Johns R.) (Sloss.); Sanford (Rothschild and Jordan); [one specimen from Agric. Exp. Sta. grounds, Gainesville, Sept. 30].

Larva on *Juglans* and *Ostrya.*

Extends to Canada, Missouri and Texas.

Pseudosphinx tetrio *Linn.* Florida (Sloss.).

Larva on *Plumeria rubra* and *Jasminium.*

Occurs in Texas and through Mexico and the Antilles to Paraguay.

Erinnyis alope *Dru.* (*Dilophonota*). Indian River (A. M. N. H., Wittfeld); Lake Worth (Sloss., Dyar); Fort Myers, Apr. 22 (A. M. N. H., Ds.); Chokoloskee (Barnes).

Larva on *Jatropha* and *Carica papaya.*

Extends as a straggler to New Jersey, through the Antilles and Mexico to Argentina.

Erinnyis lassauxii merianæ *Grt.* (*Dilophonota*). Florida (Sloss.).

Larva on *Morrenis.*

Occurs in Central America and the West Indies. The typical form of this species is confined to South America. Other forms occur in South and Central America and the Antilles.

Erinnyis ello *Linn.* (*Dilophonota*). Indian River (A. M. N. H., Wittfeld); Lake Worth, Dade Co. (Dyar); Miami, between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.); [St. Augustine (Johnson)].

Larva on *Euphorbia heterophylla* and *E. cyathophora.*

Extends as a wanderer to Canada, Ohio, California through Mexico and the Antilles to Argentina.

Erinnyis œnotrus *Stoll.* (*Dilophonota*). Florida (Sloss.).

Larva on *Morrenia.*

Occurs in Texas and the West Indies.

Erinnyis crameri *Schaus.* (*Dilophonota*). Florida (Dyar).

Extends through Mexico and the Antilles to Paraguay.

Erinnyis obscura *Fabr.* (*Dilophonota*). Jacksonville, Enterprise (Sloss.); Indian River (A. M. N. H.); Lake Worth (Dyar, Sloss.); Punta

Gorda, Feb. (Sloss.); Fort Myers (McD.), Apr. 22, 23 (A. M. N. H., Ds.); South Bay, Lake Okeechobee, May 2, Everglade, July (Ds.); Chokoloskee (Barnes); Biscayne Bay (Sloss.); Cocoanut Grove, Sept. 14 (Ds.).

Larva on *Philibertia viminalis* and *Vincetoxicum palustre.* Has been reported from Jamaica on " wild watplant."

Extends to Canada (as a straggler), Missouri and through Mexico and the Antilles to Argentina. A form occurs in the Galapagos Islands and the continental and Antillean forms may be divided into three subspecies.

Grammodia caicus *Cram.* (*Dilophonota*). Chokoloskee (Barnes); Biscayne Bay (Sloss.).

Extends through the Antilles and Central America to Buenos Ayres.

Pachylia ficus *Linn.* Lake Worth (Dyar); Everglade (McD.), Apr. 6, (Ds.); Miami, Jan. (Sloss.); between Jan. 28 and Feb. 8 (Hebard); Key West (Grt.).

Larva on *Ficus.*

Extends through the Antilles to Buenos Ayres. [Also occurs in Texas.]

Pachylia resumens *Wlk.* " Florida " (Rothschild and Jordan).

Larva on *Ficus.*

Extends through the Antilles to Buenos Ayres.

Madoryx pseudothyreus *Grt.* Punta Gorda (Sloss.); Fort Myers (Mattes); Chokoloskee (Rothschild and Jordan, Barnes); Biscayne Bay (Sloss.).

Known only from Cuba and Florida.

Hemeroplanes parce *Fabr.* Biscayne Bay (Holland).

Extends through the Antilles to southern Brazil and Bolivia.

Epistor lugubris *Linn.* (*Triptogon*). Gulf Hammock, Apr. (Castle and Laurent); Indian River (Edwards); Lake Worth (Dyar, Sloss.); between Jan. 28 and Feb. 8 (Hebard); Miami, Sept. 24 (Ds.); [St. Augustine (Johnson); near De Funiak Springs (G. C. Fisher)].

Larva on *Ampelopsis* and *Vitis.*

Extends to Massachusetts (as a wanderer) and through the West Indies to Paraguay. A subspecies occurs in Jamaica where the typical form is not found.

Epistor ocypete *Linn.* Has been doubtfully recorded from Florida (Barnes and McD.).

Occurs throughout the West Indies and Mexico to Paraguay and southern Brazil.

Cautethia grotei *Hy. Edw.* Indian River (A. M. N. H., Edwards, Wittfeld); Lake Worth (Sloss., Dyar); Palm Beach (Dyar); Marco, Apr. 18 (Ds.); Miami, between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.).

Larva on *Chiococca racemosa.*

Occurs in Florida and the Bahamas.

Perigonia lusca interrupta *Wlk.* "Florida" (Rothschild and Jordan).

This form extends through Mexico and the Antilles to Bolivia. The typical form is confined to Cuba. Other forms occur in parts of Mexico, South America and the West Indies.

Sesia tantalus zonata *Dru.* (*Ællopos*). "Florida," Oct. 8 (Rothschild and Jordan); Lake Worth (Sloss.); Deep Lake, Apr. 13 (A. M. N. H., Ds.); Everglade, Apr. 10 (Ds.); Biscayne Bay (Sloss.); Key West, Sept. 16 (Ds.); [St. Augustine (Johnson)].

Extends to New York and Ohio (as a straggler) and through the West Indies. The typical form is confined to South America. A third form is found in Central America (and Texas?) and southward through the Andes.

Sesia fadus *Cram.* "Florida" (Barnes and McD.).

Extends southward through the Antilles to Paraguay.

Hæmorrhagia thysbe *Fabr.* (*Hemaris*). Hastings, June (Rothschild and Jordan).

Form **fuscicaudis** *Wlk.* Sanford, June (Rothschild and Jordan); LaBelle, Apr. 28 (Ds.); [a specimen of this form from Gainesville, in the collection of the Agric. Exp. Sta., Gainesville].

Form **cimbiciformis** *Stephens.* Hastings, June (Rothschild and Jordan).

Form **floridensis** *G. and R.* Melonville (Linden). This form is not synonymous with *cimbiciformis*, as Rothschild and Jordan indicate, but bears identically the same relation to *fuscicaudis* that *cimbiciformis* proper does to *thysbe*. It is the spring form of the local race *fuscicaudis*, being larger than *thysbe* and *cimbiciformis* (agreeing thus in size with *fuscicaudis*) and having the dark chestnut abdomen characteristic of this form.

Larva on *Viburnum, Symphoricarpos, Prunus, Cratægus* and *Lonicera.*

Extends to Canada, Iowa and Texas. The race *fuscicaudis* with its early form *floridensis* is found only in the extreme southern portion of this range and may indeed be confined to Georgia and Florida.

Hæmorrhagia diffinis *Bd.* (*Hemaris*). Tallahasee (A. M. N. H.).

Larva on *Symphoricarpos, Lonicera, Apocynum.*

Extends to Canada, British Columbia, South Dakota and Texas. Other races occur in the Pacific subregion and in the Southwest.

Pholus satellitia posticatus *Lucas.* "Florida" (Rothschild and Jordan); [near De Funiak Springs (G. C. Fisher). Mr. Johnson records *P. pandorus* Hbn., which I consider to be this form, from St. Augustine.]

Larva on *Vitis* and *Ampelopsis.*

Occurs in Florida, Cuba and the Bahamas. Other forms occur in North America, except Florida, in the West Indies and in Mexico and South America.

Pholus achemon *Drury.* [A specimen of this species from Lake City, in the collection of the Agric. Exp. Sta., Gainesville.

Food-plants: *Vitis* and *Ampelopsis.*

Habitat: Nearctic Region, from the Atlantic to the Pacific, extending into Mexico (Rothschild and Jordan).]

Pholus vitis *Linn.* Gulf Hammock, Apr. (Castle and Laurent); Chokoloskee (Barnes); Biscayne Bay (Sloss.); [St. Augustine (Johnson)].

Larva on *Vitis* and *Ampelopsis.*

Extends to New England and through Mexico and the Antilles to Paraguay.

Pholus fasciatus *Sulzer.* "Florida" (Koebele); La Grange, Sept., larve (Ds.).

Larva on *Jussieua.*

Extends to New England and through the Antilles to Patagonia.

Pholus labruscæ *Linn.* (*Argeus*). Punta Gorda (Sloss.); South Bay, Lake Okeechobee, Apr. 29 (Ds.); Miami, Jan. (Sloss.).

Larva on *Vitis, Ampelopsis.*

Extends to Canada, Texas and through Mexico and the Antilles to Patagonia.

Ampeloeca versicolor *Harr.* (*Ampelophaga*). Biscayne Bay (Sloss.).

Larva on *Cephalanthus occidentalis, Hydrangea arborescens* and *Nesaea verticillata.*

Extends to Canada and Missouri.

Ampeloeca myron cnotus *Hbn.* (*Ampelophaga*). "Florida," May, Aug. (Rothschild and Jordan); Indian River, Lakeland, May 5 (A. M. N. H.); Lake Worth (Sloss.); Fort Myers, Apr. 23 (Ds.); Biscayne Bay (Sloss.); [Gainesville, June 17, in the collection of the Agric. Exp. Sta., Gainesville].

Larva on *Vitis, Ampelopsis* and *Viburnum.*

This very distinct form of *myron* has been reported from as far north as New Jersey. The typical form occurs from Canada to North Carolina (perhaps further south) and westward to Iowa.

Amphion nessus *Cram.* Sanford, June, Titusville, Aug. (Rothschild and Jordan); Lake Worth (Sloss.); [St. Augustine (Johnson)].

Larva on *Epilobium, Fuchsia, Ampelopsis* and *Vitis.*

Extends to Canada, Iowa and Texas.

Proserpinus guaræ circæ *Hy. Edw.* (*Lepisesia*). Pensacola, Apr. 14 (Sloss.).

Larva on *Guara biennis.*

Known from Georgia, Alabama. The typical form occurs from Georgia to Texas.

Xylophanes pluto *Fabr.* (*Calliomma*). South Florida (Dyar); Punta Gorda, Mar., Charlotte Harbor (Sloss.); Chokoloskee (Barnes); Miami, Jan. (Sloss.); between Jan. 28 and Feb. 8 (Hebard); Biscayne Bay (Sloss.).

Larva on *Erythroxylon.*

Extends through the Antilles to Southern Brazil.

Xylophanes porcus *Hbn.* (*Theretra*). "South Florida" (Dyar); Punta Gorda, Feb. (Sloss.).

Larva on *Hamelia patens.*

Occurs in Cuba. The race, **continentalis** R. and J., which extends from Mexico to South Brazil, has been recorded from Florida by Barnes and McDunnough.

Xylophanes chiron nechus *Cram.* "Florida" (Rothschild and Jordan).

Extends through Mexico and the Antilles to Uruguay. The typical form is found in Jamaica and St. Lucia.

Xylophanes tersa *Linn.* (*Theretra*). Gulf Hammock (Castle and Laurent); Indian River (Sloss.); Boca Grande, Apr. (Ds.); Chokoloskee (Barnes); between Jan. 28 and Feb. 8 (Hebard); [Agric. Exp. Sta. grounds, Gainesville, Sept. 26; Gainesville, Sept. 27; Monticello, Oct. 8; St. Augustine (Johnson)].

Larva on *Spermacoce, Bouvardia,* and *Manettia.*

Extends to Canada, Missouri, Texas, through Central America and the Antilles to Argentina.

Celerio lineata *Fabr.* (*Deilephila*). Florida (B. and McD.).

Larva on *Galium, Vitis, Rumex, Oenothera, Pyrus, Fuchsia, Portulaca, Prunus, Epilobium* and *Polygonum.*

Extends to Canada, British Columbia, Arizona and through the Antilles to Argentina. It has not, however, been recorded from Brazil.

SATURNIIDÆ.

Samia cecropia *Linn.* [Near de Funiak Springs (G. C. Fisher).

Food plants: maple, willow, wild-cherry, lilac, etc.

Extends to Canada and the Mississippi.]

Tropæa luna *Linn.* Var. **dictynna** *Wlk.* Tallahassee (A. M. N. H.); [Devils Mill Hopper, Gainesville, Sept. 27; near De Funiak Springs (G. C. Fisher); St. Augustine (Johnson)].

Larva on *Juglans, Liquidamber, Betula, Hicoria, Fagus,* etc.

The typical form extends to Canada and Missouri.

All the specimens from the more southern part of this range seem to belong to the form *dictynna* which in the North is a variety occurring singly among typical specimens of the same brood.

Telea polyphemus *Cram.* Jacksonville (Sloss.); La Grange, cocoon (Ds.); Lakeland, cocoons, Fort Myers, larvæ and cocoons, early May (A. M. N. H., Ds.); Lake Worth, young larva Jan. or Feb. (Dyar); [young larvæ and old cocoons on small oaks, Crestview, Oct. 15 and 16; near De Funiak Springs (G. C. Fisher); St. Augustine (Johnson)].

Larva on *Tilia, Acer, Betula, Salix, Corylus, Hicoria, Pyrus, Prunus, Quercus, Ulmus* and *Rosa.*

Extends to Canada and Missouri.

Automeris io lilith *Strck.* Sanford, Jan. 27 (Sloss.); Indian River, Lakeland, Mar. 31 (A. M. N. H.); Punta Gorda, Feb., larvæ (Sloss.), Useppa, Apr. (Ds.); Fort Myers, Mar. 30, larva, Marco, Apr. 17 (A. M. N. H.), Lake Worth, Miami, larvæ (Dyar); Biscayne Bay (Sloss.); [St. Augustine (Johnson). This record was given under *H. io* Fabr.]

Larva on *Rhizophora mangle* and *Conocarpus erecta.* In the North the larva has been recorded as feeding on over eighty different plants, including *Salix, Populus, Betula, Quercus, Acer, Tilia, Zea, Myrica, Comptonia, Fagus, Corylus, Ostrya* and *Carpinus.* For exhaustive list of food plants see Papilio, IV, p. 155.

Probably not recorded outside of Florida. The typical form extends to Canada, Missouri and Mexico.

Hemileuca maia *Dru.* [St. Augustine (Johnson).

Food plant: oak.

Extends to Maine, Nova Scotia and the Mississippi.]

CERATOCAMPIDÆ.

Anisota stigma *Fabr.* West Palm Beach, Jan., larvæ (Dyar).

Larva on *Quercus* and *Corylus.*

Extends to Canada, Missouri and Kansas.

Anisota consularis *Dyar.* West Palm Beach, Jan., larvæ (Dyar).

Larva on live oak.

Known only from Florida.

Citheronia regalis *Fabr.* Crescent City (Hubbard); [near De Funiak Springs (G. C. Fisher).]

Larva on *Juglans, Hicoria, Diospyros virginiana, Rhus, Liquidamber, Platanus, Fraxinus* and *Syringa.*

Extends to Massachusetts, Missouri and Texas.

Citheronia sepulchralis *G. and R.* Jacksonville (Sloss.); Fort Myers (Mattes).

Larva on *Pinus strobus* and *P. rigida.*

Extends along the Atlantic coast to southern Maine and New Hampshire.

Basilona imperialis *Drury.* Useppa, Apr. (Mr. and Mrs. Hunt); [near De Funiak Springs (G. C. Fisher)].

Larva on *Tilia, Rhus glabra, Acer, Gleditsia, Liquidamber, Sassafras, Ulmus, Platanus, Castanea, Quercus, Fagus, Betula, Pinus* and many other plants. For exhaustive list of food plants see Entomologica Americana, II, p. 53.

Extends to Quebec, Missouri and Mexico.

AMATIDÆ.[1]

Cosmosoma myrodora *Dyar.* Haulover, Mar. 9 (Hubbard and Schwarz); Enterprise, Apr. (Castle and Laurent); Indian River (A. M. N. H., C. V. Riley); Lake Worth (Sloss., Dyar); Palm Beach (Dyar); Forth Myers (McD.), Apr. (A. M. N. H.); Miami (Schaus.); [St. Augustine (Johnson)].

Larva on *Mikania scandens.*

Known only from Florida.

This is the species usually passing under the name *auge* Linn., which Dyar says does not occur in the United States.

Pseudomya minima *Grt.* Miami (Schaus, Ottolengui), Jan. (Sloss.); Cocoanut Grove, Sept. 14 (Ds.); Biscayne Bay (Sloss.).

Larva on *Myginda ilicifolia.*

Occurs in Cuba.

Syntomeida ipomeæ *Harr.* Miami, Jan., Biscayne Bay (Sloss.); [St. Augustine (Johnson); one specimen taken at light, Monticello, Oct. 7].

Occurs in Georgia.

Syntomeida epilais var. **jucundissima** *Dyar.* Lake Worth, Palm Beach (Dyar); Miami (Schaus, Ottolengui), Jan. (Sloss.); Cocoanut Grove (Schwarz), Sept. 14, common (Ds., Sleight); Chokoloskee (Barnes);

---

[1] Equals Syntomidæ of authors. See Hampson, Cat. Phalænæ, Supplement, I (1914).

Biscayne Bay (Sloss.); Homestead, Sept. 21, Key West, Sept. 18, larvæ and adults (Ds.); [Miami, Aug. (Coll. A. M. N. H.)].

Larva on *Echites umbellata, Nerium odorum* and *Oleander.*

The typical form occurs in Mexico and Central America.

Didasys belæ *Grt.* Indian River (A. M. N. H.); Punta Gorda, Feb. (Sloss.), Nov. 13 (A. M. N. H., Ds.); Charlotte Harbor (Sloss.); Fort Myers, Apr. 26 (A. M. N. H.); Lake Worth (Dyar); Allen River to Deep Lake, Apr. 12 (A. M. N. H., Ds.); Miami, Feb., Biscayne Bay (Sloss.); Cedar Keys, June 4 (Hubbard and Schwarz); [seemingly common, Bayou Chico, Pensacola, Oct. 12. Specimens were taken in marshy areas back from the shore.]

Known only from Florida.

Lymire edwardsi *Grt.* Indian River (Wittfeld); Lake Worth (Dyar); South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.); Fort Myers, Mar. 31, Nov. 12, Everglade, Apr. 15 (A. M. N. H., Ds.); Biscayne Bay (Sloss.).

Larva on *Ficus pedunculata.* (Rubber trees defoliated by them according to accounts of natives. —Dyar).

Known only from Florida.

Eucereon carolina *Hy. Edw.* Indian River (A. M. N. H.); Lake Worth (Dyar); Fort Myers (McD.), Apr. 25 (A. M. N. H.).

Larva on *Philibertia viminalis* and *Vincetoxicum palustre.*

[Also occurs in Mexico and Central and South America.]

"Our specimen lacks vein 4 of secondaries and would fall according to Hampson's tables into Section 1 B of genus *Neacerea.* The species is at any rate distinct from *confinis* H.-S. The primaries are more suffused olivaceous and less contrasting white and brown. The spots are smaller especially in submarginal and terminal areas, and the terminal row of dashes is unbroken; *confinis* according to Herrick-Schaeffer's figure and a specimen before us lacks a dash between the cubital branches." (McD.)

Scepsis fulvicollis *Hbn.* "Florida" (A. M. N. H.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on grasses.

Extends to Canada, Vancouver and the Rocky Mountains.

Dahana atripennis *Grt.* Indian River (A. M. N. H.); Enterprise, Apr. (Castle and Laurent), May 8 (Hubbard and Schwarz); Lakeland, Nov. 10 (A. M. N. H.), larva (McD.), May 7 (Ds.); Punta Gorda, Nov. 14 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.); Devils Mill Hopper, Gainesville, Sept. 27; Payne Prairie, Gainesville, Oct. 2; Lake Miceosukee, Monticello, Oct. 6].

Larva on Spanish moss.

Known only from Florida.

NOLIDÆ.

Celama sorghiella *Riley.* Hastings, Aug. 1 (A. M. N. H.); Fort Myers (McD.); Everglade (McD.), Apr. 6, 8 (A. M. N. H.).

Larva on *Sorghum vulgare.*

Extends to North Carolina and through the Antilles to Argentina.

Nola laguncularlæ *Dyar.* (*Celama obliquata* B. & McD.). Lake Worth (Dyar); Fort Myers, Apr. 23, Marco, Apr. 17 (A. M. N. H.); Everglade, Apr. 10 (A. M. N. H.), Apr. 16–23 (McD.).

Larva on *Laguncularia racemosa.*

Known only from Florida.

Negetia formosalis *Wlk.* South Bay, Lake Okeechobee, Apr. 30, Everglade, Apr. 11 (A. M. N. H.).

Extends to Buffalo and Texas.

Rœselia minuscula *Zell.* Lakeland (McD.), May 8 (A. M. N. H.).

The specimen in the Museum is much smaller than the typical form of *minuscula* (expanding only 15 mm.) and may represent a new species. More material is required to determine this satisfactorily.

Larva on *Quercus.*

Extends to New Jersey, California and through Mexico to Bolivia.

LITHOSIIDÆ.

Crambidia pallida *Pack.* Marco, Apr. 17, Everglade, Apr. 7, 10 (A. M. N. H.). All the specimens are considerably smaller than northern examples in the Museum.

Extends along the Atlantic coast to Canada and as far west as Quebec.

Crambidia uniformis *Dyar.* Fort Myers (McD.).

Comacla simplex *Wlk.* Charlotte Harbor (Sloss.); Everglade (McD.), Apr. 6 (A. M. N. H.).

Has been reported from Texas and Montana.

Afrida ydatodes *Dyar.* (*Aresia parva* B. and McD.). "Florida" (Beutenmüller); Fort Myers, Apr. 23, Everglade, Apr. 7 (A. M. N. H.), Apr. 1–7 (McD.).

Known only from Florida.

Illice unifascia *G. and R.* Florida Grt.

Extends to New York, Texas and Mexico.

Illice subjecta *Wlk.* Everglade, Apr. 9, 17 (A. M. N. H.); Biscayne Bay (Sloss.); [one specimen at light, De Funiak Springs, Oct. 19].

Larva on lichens.

Extends to New York and Texas.

Illice striata *Ottl.* Enterprise, Miami (Hampson).

Has been recorded from Colorado.

Clemensia albata *Pack.* Lakeland, May 6, La Belle, Apr. 27 (A. M. N. H.).

Extends to Canada, California, and Costa Rica.

Palpidia pallidior *Dyar.* Fort Myers (McD.), Mar. 31 (A. M. N. H.), Apr. 22 (Ds.); Cocoanut Grove (Schwarz); Biscayne Bay (Sloss.).

Known only from Florida.

Hypoprepia miniata *Kirby.* Allen River to Deep Lake, Apr. 14 (A. M. N. H.).

Larva on lichens.

Extends along the Atlantic coast to Canada.

Neoplynes eudora *Dyar.* Fort Myers, Apr. 23 (A. M. N. H.).

Described from Texas and not heretofore rediscovered.

ARCTIIDÆ.

Eupseudosoma involuta florida *Grt.* Indian River (A. M. N. H.); Fort Myers (McD.), Apr. 24 (A. M. N. H.); Charlotte Harbor (Sloss.); Lake Worth (Dyar).

Larva on *Psidium pyrifera, Eugenia buxifolia* and *E. procera.*

Known only from Florida. The typical form extends through Mexico and the Antilles to Brazil.

Ammalo insulata *Wlk.* Fort Myers (McD.); Biscayne Bay (Sloss.).

Extends through Mexico and the Antilles to Brazil.

Ammalo tenera *Hbn.* Lakeland, May 5 (A. M. N. H.); Fort Myers, Apr. 22 (Ds.).

In the above specimens, the yellow is confined to the base of the wing, as in the form *sciurus* described from California by Boisduval. They are not, however, so large as this Pacific Coast variety, but average smaller than the typical form, approaching in this respect, white specimens of *eglenensis.*

Larva on *Apocynum androsæmifolium.*

Extends to Canada, British Columbia and California.

Ammalo eglensis *Clem.* Florida (Sloss.).

Variety **inopinatus** *Hy. Edw.* Indian River (Edw.).

Larva on *Asclepias.*

Extends through the Atlantic States to New York.

Halisidota tesselaris *S. and A.* [Gainesville (Coll. Agric. Exp. Sta.)·

Food Plants: oak, willow, maple, beech, sycamore, etc.

Extends over the Atlantic States.]

Halisidota cinctipes *Grt.* Biscayne Bay (Sloss.).

Larva on *Coccoloba floridana* and *C. uvifera.*

Extends to Arizona, through Mexico and the Antilles to Brazil.

Halisidota longa *Grt.* Tallahassee (Schwarz); Jacksonville (Sloss.); Enterprise (Grote, Schwarz); Lakeland, Mar. 28 (A. M. N. H.), Nov. 9 (Ds.); Charlotte Harbor, Punta Gorda (Sloss.); Fort Myers (McD.), Apr. 3, 22 (Ds.); Lake Worth (Sloss.); LaBelle, Apr. 28 (Ds.); Everglade, Apr. 15 (A. M. N. H.); [Gainesville (Coll. Agric. Exp. Sta.)].

Known only from Florida.

Holomelina læta *Guer.* (*Eubaphe*). Tampa (Hampson); Charlotte Harbor (Sloss.); Fort Myers (McD.), Mar. 31, Apr. 8 (A. M. N. H., Ds.).

Extends to Massachusetts and Texas.

Holomelina aurantiaca *Hbn.* (*Eubaphe*). Charlotte Harbor (Sloss.).

Variety **brevicornis** *Wlk.* Florida (Hampson).

Larva on *Plantago* and grasses.

Extends to Hudson Bay, the Rocky Mountains and Central America.

Holomelina rubicundaria *Hbn.* (*Eubaphe*; Dyar 834*a*). Hastings, Mar., Sept. 22, 30, Newberry, Nov. 10 (A. M. N. H.); Gulf Hammock, Apr., Enterprise, Apr. (Castle and Laurent); La Grange, Sept. 12 (Ds.); Lakeland, May 4, 5, 6, 8, 9 (A. M. N. H., Ds.); Fort Myers (McD.), Mar. 30, 31, Apr. 1, 24, 25, La Belle, Apr. 26, 28, South Bay, Lake Okeechobee, May 2 (A. M. N. H., Ds.); [Gainesville (Coll. Agric. Exp. Sta.); Monticello, Oct. 7; Lake Miccosukee, Monticello, Oct. 8; Crestview, Oct. 17 and 18; De Funiak Springs, Oct. 19; Orlando, Mch. 27–31 (Pearsall)].

Extends to Texas.

This species (=*diminutiva* Graef) is widely distinct from *aurantiaca,* of which it is usually regarded a form, by its smaller size, deep orange primaries and vermilion secondaries. The coloring, also, is nearly always uniform, whereas in *aurantiaca,* it is broken on the primaries by dusky clouds or spots and on the secondaries by bands. Of the forty odd specimens of *rubicundaria* before me, only two show a suggestion of a dusky border to the hind wings. I have over one hundred specimens of *aurantiaca* for comparison with this southern species.

Euerythra phasma *Harv.* Ormond, Rockledge (Sloss.).

Occurs in Texas and to Missouri.

Diacrisia virginica *Fabr.* (*Spilosoma*). Fort Myers, Apr. 22, South Bay, Lake Okeechobee, Apr. 29 (A. M. N. H.), Apr. 30 (Ds.); Lake Worth (Dyar); Everglade, July (Ds.).

Larva a general feeder on low herbage.

Extends to Hudson Bay, Vancouver Island and Mexico. It has not been reported from the southern Pacific States.

Diacrisia isabella *S. and A.* (*Isia*). Lakeland, May 8 (A. M. N. H.); Fort Myers, Mar. 31, La Belle, Apr. 27 (Ds.).

Larva a general feeder on low herbage.

Extends to Canada and the Pacific Coast.

Hyphantria cunea *Drury*. [We have no Florida records for this form.

Ab. **punctata** *Fitch*. Gainesville (Coll. Agric. Exp. Sta.).

Food plants: various orchard and shade trees.

Extends to Canada, the Pacific and into Mexico.]

Estigmene acræa *Drury*. Lake Worth (Dyar); Fort Myers, Mar. 31 (A. M. N. H.); [near De Funiak Springs (G. C. Fisher)].

Larva a general feed on low plants.

Extends to Hudson Bay, and the Pacific Coast. A form occurs in Mexico and Central America.

Estigmene congrua *Wlk.* [Gainesville (Coll. Agric. Exp. Sta.).

Food plants: various species of low plants.

Extends along the Atlantic States and to the Rocky Mountains.]

Ecpantheria deflorata *Fabr.* Jacksonville, Ormond (Sloss.); Lake Worth (Dyar); Biscayne Bay (Sloss.); [St. Augustine (Johnson)].

Variety **denudata** *Sloss.* Fort Myers, Apr. 1, 22, 23 (A. M. N. H., Ds.); Lake Worth, Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Euphorbia cyathophora, Ricinus communis, Helianthus, Plantago, Salix* and various other plants.

The typical form ranges to New York, Missouri and Texas; the variety seems to be confined to Florida and Georgia.

Apantesis michabo *Grt.* Suwanee Springs, Apr. 15, Ormond, Winter Park (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends along the Atlantic coast to New Hampshire.

Apantesis arge *Drury*. [Near De Funiak Springs (G. C. Fisher).

Food plants: *Plantago, Chenipodium,* etc.

Extends over practically the entire United States and Canada.]

Apantesis phyllira *Drury*. Lake Worth (Sloss.); [near De Funiak Springs (G. C. Fisher)].

The larva is a general feeder.

Extends to New England and Colorado.

Apantesis vittata *Fabr.* Miami (Schaus).

Variety **radians** *Wlk.* Hastings (A. M. N. H.); Fort Myers (McD.), Apr. 23, 24 (A. M. N. H., Ds.).

Variety **phalerata** *Harr.* Lakeland, Mar. 28 (A. M. N. H.); Fort Myers (McD.), Apr. 22, Mar. 31, La Belle, Apr. 26 (Ds.); South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.); Everglade, May, Miami, Sept. 22 (Ds.).

The larva is a general feeder: *Taraxacum* and *Plantago major* have been specifically recorded.

Extends to Canada and Missouri.

Dr. McDunnough says of his specimens taken at Fort Myers: "The males were all of the form with pale colored secondaries and slight black costal patch. The single female captured had the markings of the primaries reduced to a costal and median dash; the secondaries rosy with broad black border much reduced opposite lower angle of cell and a spot in the cell." These represent *phalerata* and *radians* respectively. Dr. Ottolengui contends that *radians*, together with the form here listed as *phalerata*, represents a species distinct from *vittata*.

Apantesis nais *Drury.* Charlotte Harbor, Biscayne Bay (Sloss.).

The larva a general feeder on low plants and has been specifically recorded on dandelion, plantain and *Chenopodium.*

Extends to Canada and Missouri.

Apantesis placentia var. **flammea** *Neum.* Indian River (Wittfeld).

Extends to Georgia and Texas.

Pygarctia vivida *Grt.* "Florida" (Brooklyn Museum).

Extends to Texas.

Pygarctia abdominalis *Grt.* "Florida" (Grt.).

Has also been found in New Jersey and probably extends along the coast between these two points.

Pygarctia grossbecki *Davis.* Lake Worth, Palm Beach (Sloss.); Fort Myers, Apr. 22 (Ds.); Biscayne Bay (Sloss.).

Known only from Florida.

Euchætias egle *Drury.* "Florida" (Sloss.).

Larva on *Asclepias.*

Extends to Massachusetts, Quebec and Texas.

Seirarctia echo *S. and A.* Ormond, Cold Harbor, Apr., Charlotte Harbor (Sloss.).

Larva on *Sabal palmetto.*

Occurs in Georgia.

Calidota strigosa *Wlk.* Lake Worth, Palm Beach (Dyar); Biscayne Bay, Key Largo (Sloss.).

Larva on *Guettards elliptica.*

Extends to Texas and through the Antilles. A subspecies occurs in Jamaica.

Utetheisa ornatrix *Linn.* Lake Worth (Sloss.).

Extends to Pennsylvania, Texas, Mexico and the Antilles to Bolivia and Brazil. Occurs also in the Galapagos and Marquesas Islands.

Utetheisa bella *Linn.* Jacksonville (Sloss.), Nov. 5 (Ds.); Pablo Beach, Sept. 5, 27 (Ds., Sleight); Newberry, Nov. 19, Titusville, Nov. 8 (A. M. N. H.); La Grange, Sept. 9, 11 (Ds., Sleight); Enterprise (Sloss.), Apr. (Castle and Laurent); Indian River, Lakeland, Mar. 28, May 4, 7 (A. M. N. H., Ds.), Nov. 10 (A. M. N. H.); Palm Beach (Sloss.); Lake Worth (Dyar); Punta Gorda, Nov. 11, 17 (A. M. N. H.); Useppa Island, May, Lacosta Island, Apr. (Ds.); Fort Myers (McD.), Mar. 21, Apr. 1, 24, 26, Nov. 15, La Belle, Apr. 27, 28, South Bay, Lake Okeechobee, Apr. 19, 21, Miami, Nov. 5 (A. M. N. H., Ds.); [common, Devils Mill Hopper, Gainesville Sept. 27; East Gainesville, Sept. 29; Monticello, Oct. 5; Lake Miceosukee, Monticello, Oct. 8; Fisherville, Pensacola, Oct. 11; Star Lake, Pensacola, Oct. 13; very common, Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 15 and 16; Lake Stanley, De Funiak Springs, Oct. 18; near De Funiak Springs (G. C. Fisher); St. Augustine (Johnson)].

Variety **terminalis** *N. and D.* Indian River (A. M. N. H.).

Variety **venusta** *Dalm.* Rockledge, Lake Worth, Biscayne Bay (Sloss.).

Larva on *Crotalaria* and *Lespedeza.*

Extends to Quebec, Missouri, Texas and Mexico. In the Antilles only the form *venusta* is found.

AGARISTIDÆ.

Alypia octomaculata *Fabr.* "Florida" (Grote coll.).

Larva on *Vitis* and *Ampelopsis.*

Extends to Quebec, Missouri and Texas.

Alypia wittfeldi *Hy. Edw.* Indian River (Wittfeld); Lake Worth, Biscayne Bay (Sloss.); [St. Augustine (Johnson).

Known only from Florida.]

This is said by Hampson to be an aberration of the preceding species.

PANTHEIDÆ.

Panthea furcilla *Pack.* "Florida" (Sloss.).

Larva on *Larix, Pinus,* and *Tilia.*

Extends to Canada and Wisconsin.

Charadra deridens *Gn.* La Belle, larvæ, Apr. 28, adults May 21, June 1 (A. M. N. H.).

Larva on *Quercus, Betula* and *Ulmus.*

Extends to Canada, Colorado and Texas.

Charadra illudens *Wlk.* "Florida" (Dyar).

Reported from Missouri and Mexico.

Charadra sudena *Sm.* Miami (Barnes).

Known only from Florida.

NOCTUIDÆ.

Apatela lætifica *Sm.* (*Acronycta*). "Florida" (Smith).

Extends along the Atlantic Coast to New York.

Apatela lobeliæ *Gn.* (*Acronycta*). "Florida" (Doubleday).

Larva on *Prunus* and *Quercus.*

Extends to Canada, Minnesota, Kansas and Texas.

Apatela furcifera *Gn.* (*Acronycta*). "Florida" (Smith).

Larva on wild, fire and choke cherry.

Extends to Maine, Canada and Missouri.

Apatela chionochroa *Hamps.* (*lepusculina* S. and D. not. Gn.; *Acronycta*). "Florida" (Hampson).

Extends to Hudson Bay, Montana and Colorado.

Apatela clarescens *Gn.* (*Acronycta*). South Bay, Lake Okeechobee, May 1, Marco, Apr. 21 (A. M. N. H.).

Larva on mountain ash, wild and cultivated cherry, plum and apple.

Extends along the Atlantic Coast to Nova Scotia.

Apatela hamamelis *Gn.* (*Acronycta*). Lakeland, emerged June 24 (A. M. N. H.).

Larva on *Hamamelis virginiana,* oak and walnut.

Extends along the Atlantic Coast to New Jersey.

Apatela lithospila *Grt.* (*Acronycta*). "Florida" (Smith).

Larva on hickory, oak and chestnut.

Extends to Massachusetts, New York and the Pacific States.

Apatela tritona *Hbn.*(*Acronycta*). "Florida" (Sloss.).

Larva on *Vaccinium,* deer-berry and *Azalea.*

Extends to Canada and the Pacific Coast.

Apatela afflicta *Grt.* (*Acronycta*). "Florida" (Doubleday).

Larva on oak.

Extends to Canada, the Rocky Mts. and Mexico.

Apatela brumosa *Gn.* (*persuasa* Harv.; *Acronycta*). "Florida" (Sloss.); Archer, Mar. (Smith).

Larva on *Corylus* and *Prunus,* [willow, birch and alder (Holl.)].

Occurs in Missouri and Texas, and is doubtfully recorded from Colorado and New Mexico.

Apatela impressa *Wlk.* (*Acronycta*). "Florida" (Smith).

Larva on willow, [plum, hazel, currant and blackberry (Holl.).]

Extends to Hudson Bay, Manitoba and Colorado.

Apatela longa *Gn.* (*xyliniformis* Gn.; *Acronycta*). "Florida," March (Smith).

Larva on birch and blackberry.

Extends to Canada, Missouri and Texas.

Apatela oblinita *S. and A.* (*Eulonche*). "Florida" (Sloss.).

Larva on alder, peach, asparagus, *Polygonum* and many other plants.

Extends to Nova Scotia and Manitoba.

Arsilonche henrici *Grt.* (*albovenosa* Auct.; *Simyra*). Biscayne Bay (Sloss.).

Larva on grasses.

Extends to Massachusetts, Ottawa, California and Cuba.

Harrismemna trisignata *Wlk.* "Florida" (Sloss.).

Larva on lilac, winterberry, huckleberry and *Cephalanthus occidentalis.*

Extends to Canada, Missouri and Texas.

Jaspidia nana *Hbn.* "Georgia in Florida" (Hubner).

Jaspidia teratophora *H.-S.* (*Amyna*). "Florida" (Doubleday).

Extends to Canada, Iowa and Texas.

Diphthera fallax *H.-S.* (*Agriopodes*). "Florida" (Sloss.).

Larva on *Viburnum* and poplar.

Extends to Canada, Illinois and Texas.

Polygrammata hebraica *Hbn.* "Florida" (Smith).

Larva on *Nyssa sylvatica.*

Extends to Massachusetts and Texas.

Cyathissa percara *Morr.* (*Emarginea*). "Florida" (Sloss.).

Extends to Texas and Colorado.

Platysenta videns *Gn.* "Florida" (Smith).

Larva on? *Solidago.*

Extends to Massachusetts and Colorado.

Senta enervata *Gn.* (*Nonagria*). "Florida" (Doubleday).

Known only from Florida.

Gonodes liquida *Moesch.* Stemper, Sept. 19 (Marloff).

Extends through Mexico and the Antilles to Paraguay.

Anorthodes tarda *Gn.* (*prima* Sm.; *Athetis*). Archer, May 24 (Smith).

Extends to Ohio and Missouri.

Caradrina spilomela *Wlk.* Biscayne Bay (Sloss.).

Extends to California, and through Mexico and the Antilles to Paraguay.

Perigea xanthioides *Gn.* Charlotte Harbor (Sloss.).

Extends to Canada, Kansas, Texas and through the Antilles to Brazil.

Perigea apameoides *Gn.* (*icole* Grt.). Fort Myers, Apr. 3, 23, 29, Marco, Apr. 17, Allen River to Deep Lake, Apr. 14 (A. M. N. H., Ds.); Everglade, Apr. 5, 6, 7, 8, 9, 11, 16 (A. M. N. H., Ds., McD.); Miami, Sept. 23, Big Pine Key, Sept. 20 (Ds.); [De Funiak Springs, Oct. 17].

Extends through Mexico and the Antilles to Argentina.

Perigea selenosa *Gn.* (*vecors* Gn.). Lake Worth (Sloss.).

Extends to Massachusetts, Colorado, and through Mexico and Central America to Brazil. Occurs also in Jamaica.

Perigea cupentia *Cram.* (*epopea* Cram.). Fort Myers (McD.); South Bay, Lake Okeechobee, Apr. 29, 30, May 1, Marco, Apr. 1 (A. M. N. H., Ds.); Chokoloskee (Barnes); [De Funiak Springs, Oct. 18].

Extends to Maine and through the Antilles to Paraguay. Occurs also in Panama, Costa Rica and Guatemala.

Perigea sutor *Gn.* (*cervina* Sm.). " Florida " (Sloss.); Hastings, Oct. 24, Fort Myers, Apr. 23 (A. M. N. H.); South Bay, Lake Okeechobee, Apr. 30, May 1 (Ds.).

Extends to Massachusetts, Texas and through Mexico and the Antilles to Argentina.

Perigea pulverulenta *Sm.* (*Andropolia*). " Florida " (Sloss.).

Extends to Colorado and Alberta.

Perigea concisa *Wlk.* Miami (Schaus.); Everglade (McD.), Apr. 7, 9 (A. M. N. H., Ds.).

Occurs in Mexico, the Antilles and to Argentina.

Oligia festivoides *Gn.* (*Monodes*). " Florida " (Hampson).

Extends to Canada and Texas.

Oligia chalcedonia *Hbn.* (*Monodes*). St. Johns Bluff (Doubleday); Charlotte Harbor (Sloss.); South Bay, Lake Okeechobee, Apr. 29 (A. M. N. H.); Lake Worth (Dyar); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.); De Funiak Springs, Oct. 18].

Extends to Canada, Colorado and New Mexico.

Oligia exesa *Gn.* (*Monodes*). " Florida " (Doubleday); Enterprise (Hampson); South Bay, Lake Okeechobee, Apr. 29 (Ds.).

Known only from Florida.

Oligia fuscimacula *Grt.* (*Monodes*). " Florida " (Sloss.).

Known also from Texas.

Oligia grata *Hbn.* (*Monodes*). " Florida " (Hampson).

Extends to Maryland, Mississippi, Kansas and through Mexico and Central America.

Oligia nucicolora *Gn.* (*Monodes*). Hastings, Oct. 24, 25, 26, 27, 28,

(A. M. N. H.); Enterprise (Hampson); Lake Worth (Dyar); South Bay, Lake Okeechobee, Apr. 29–May 1 (A. M. N. H., Ds.); Fort Myers, Apr. 22, Everglade, Apr. 11 (Ds.); Chokoloskee (Barnes).

Extends through the Antilles to Peru. Occurs also in Texas.

Oligia agrotina *Gn.* (*trientiplaga* Wlk.; *Monodes*). Lake Worth (Dyar).

Extends through Mexico and the Antilles to Paraguay.

Hadena patina *Harv.* (*Dipterygia*). "Florida" (Sloss.).

Extends to the District of Columbia and Arizona.

Hadena turbulenta *Hbn.* (*Trachea*). "Florida" (Doubleday).

Larva on *Smilax.*

Extends along the Atlantic coast to New York.

Hadena tapeta *Sm.* (*Oligia*). Cocoanut Grove (Schwarz).

Known only from Florida.

Hadena miseloides *Gn.* (*Trachea*). "Florida" (Sloss.); St. Johns Bluff (Doubleday); [Monticello, Oct. 8; Gainesville (Coll. Agric. Exp. Sta.].

Larva on *Smilax rotundifolia.*

Extends to New York, Kansas and Texas.

Pyrophila tragopoginis *Linn.* (*Amphipyra*). Lake Worth (Sloss.).

Larva on *Plantago, Aquilegia* and hawthorn.

Extends through the eastern States to Canada. [Also from Pennsylvania west to the Mississippi.] Occurs also in Europe and Asia.

Prodenia dolichos *Fabr.* (*commelinæ* S. and A.). Jacksonville, No. 5 (A. M. N. H.); Charlotte Harbor (Sloss.); Fort Myers, Apr. 2 (Ds.).

Larva on grasses.

Extends to Massachusetts, Illinois, Texas and through Mexico and the Antilles to Argentina.

Prodenia ornithogalli *Gn.* "Florida" (Sm.); Chokoloskee (Barnes); [Gainesville, Oct. 2].

Variety **eudiopta** *Gn.* "Florida" (*Sm.*).

Extends to Massachusetts, Nebraska, California and Costa Rica.

Prodenia eridania *Cram.* South Bay, Lake Okeechobee, Apr. 30, May 1 (A. M. N. H., Ds.); Everglade (McD.), Apr. 5 (A. M. N. H.); Chokoloskee (Barnes); [Gainesville, Sept. 26].

Larva on pokeweed and "careless."

Extends into Georgia, and through Mexico and the Antilles to Argentina.

Laphygma frugiperda *S. and A.* Hastings, Oct. 24 (A. M. N. H.); Lakeland, May 7 (Ds.); Charlotte Harbor (Sloss.); South Bay, Lake Okeechobee, Apr. 29, May 1 (A. M. N. H., Ds.); [Crestview, Oct. 15 and 16].

Variety **obscura** *Riley.* South Bay, Lake Okeechobee, Apr. 29, May 1, Chokoloskee, Apr. 8 (A. M. N. H., Ds.); [Gainesville, Sept. 27; Crestview, Oct. 16; De Funiak Springs, Oct. 17].

Larva on grasses and grains, and occasionally on fruit trees.

Extends to Canada, Nebraska, Mexico and the Antilles to Argentina.

Lussa abseuzalis *Wlk.* (*nigroguttata* Grt.; *Casandria*). Charlotte Harbor (Sloss.); Fort Myers (McD.); Lake Worth (Dyar); Marco, Apr. 17 (Ds.); Everglade, Apr. 7, 15 (A. M. N. H.), Apr. 11 (Ds.); Chokoloskee (Barnes); Biscayne Bay (Sloss.).

Occurs throughout the Antilles and in Brazil.

Dr. McDunnough says that "*Pleurasympieza smithii* Moesch. from Porto Rico appear to be a synonym."

Lussa filifera *Wlk.* (*inflexa* Morr.; *Casandria*). "Florida" (Hampson); Jacksonville (Morrison).

Has been recorded from Michigan, from the Bahamas and from Haiti.

Magusa orbifera *Wlk.* (*dissidens* Feld.). Lake Worth (Dyar); Biscayne Bay (Sloss.).

Larva on *Condalia ferrea.*

Extends to New York, Wisconsin, Texas, and through Mexico and the Antilles to Argentina.

Pseudanarta aurea *Grt.* (*Copanarta*). "Florida" (Sloss.).

Occurs in Texas and Arizona.

Homohadena infixa *Wlk.* "Florida" (Doubleday).

Extends to Missouri and Texas.

Lepipolys perscripta *Gn.* Island Grove (Seifert); St. Johns Bluff (Doubleday).

Larva on *Linaria canadensis.*

Extends to Massachusetts and through Texas and Colorado to California.

Copipanolis cubilis *Grt.* "Florida" (Sloss.).

Extends to Massachusetts, Quebec and Michigan.

Copipanolis stigma *Sm.* "Florida" (Sloss.).

Known only from Florida.

Eutolype rolandi *Grt.* "Florida" (Sloss.).

Extends to Massachusetts, Missouri and Texas.

Psaphidia resumens *Wlk.* "Florida" (Doubleday).

Extends to Massachusetts, Missouri and Texas.

Agrotis ypsilon *Rott.* Lake Worth (Sloss.); [Monticello, Oct. 6].

The larva is a general feeder.

Extends to Hudson Bay, the Rocky Mountains, and through Mexico and Central America to Chili. Occurs also in Europe, Asia, Africa, Australia and Hawaii.

Agrotis dapsilis *Grt.* "Florida" (Grote); Newberry, Nov. 18 (Ds.).

Known only from Florida.

Peridroma margaritosa *Haw.* (*Lycophotia*). "Florida" (Sloss.).

Larva a general feeder.

Extends to Canada, California, and through Mexico to Chili and Argentina. Occurs also in Jamaica, Europe, Asia, Africa and Hawaii.

Peridroma infecta *Ochs.* (*incivis* Gn.; *Lycophotia*). Jacksonville, Jan. 25 (Sloss.), Sept. 28 (Ds.); Ortega, Sept. 27 (Ds.); St. Johns Bluff (Doubleday); Newberry, Nov. 18 (Ds.); Sanford, Jan. 27 (Sloss.); Titusville, Nov. 8 (A. M. N. H.); Charlotte Harbor, Punta Gorda, Feb. (Sloss.), Nov. 12 (Ds.); Lake Worth (Dyar); Fort Myers, Mar. 30, Apr. 22, 23, Everglade, Apr. 14 (A. M. N. H., Ds., McD.).

Larva on grass (*Cenchrus*).

Extends to Massachusetts, Washington, California and through Mexico and the Antilles to Argentina. Occurs also in the Bermudas.

Peridroma digna *Morr.* (*Lycophotia*). Charlotte Harbor (Sloss.).

Occurs in Texas.

Noctua lubricans *Gn.* (*Lycophotia*). "East Florida" (Doubleday); Charlotte Harbor (Sloss.).

Extends to Hudson Bay, Colorado and New Mexico.

Noctua spreta *Sm.* (*Lycophotia*). Hastings (Sm.).

Known only from Florida.

Feltia annexa *Treit.* St. Johns Bluff (Doubleday); Hastings, Oct. 24 (A. M. N. H.); Fort Myers, Mar. 30, 31, Apr. 22, 23, South Bay, Lake Okeechobee, Apr. 29, May 1 (A. M. N. H., Ds.); Everglade, Apr. 6, 7, 8, 11 (A. M. N. H., Ds., McD.).

The larva is a general feeder.

Extends to Massachusetts, New York, California and through Mexico and the Antilles to Chili and Argentina. Occurs also in the Bermudas.

Feltia malefida *Gn.* Jacksonville, Jan. 25, Punta Gorda, Feb. (Sloss.); Fort Myers, Apr. 22 (Ds.); Lake Worth (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

The larva is a general feeder.

Extends to New York, California and through Mexico and the Antilles to Argentina.

Paragrotis messoria *Harr.* (*insulsa* Wlk.; *Euxoa*). "Florida" (Sloss.).

The larva is a general feeder.

Extends to Nova Scotia, Vancouver Island and California.

Paragrotis tessellata *Harr.* (*Euxoa*). "Florida" (Sloss.).

The larva is a general feeder.

Extends to Nova Scotia, Vancouver Island and Colorado.

Mamestra lustralis *Grt.* (*Polia*). Biscayne Bay (Sloss.).

Extends to New York and Colorado.

Mamestra capsularis *Gn.* (*Epia*). St. Johns Bluff (Doubleday).

Extends to Massachusetts, Wisconsin and New Mexico.

Mamestra laudabilis *Gn.* (*Polia*). "East Florida" (Doubleday); Lake Worth (Dyar); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to New Jersey, California and Guatemala.

Mamestra erecta *Wlk.* (*Polia*). "Florida" (Doubleday).

Occurs in Texas and thence to Guatemala.

Mamestra florida *Sm.* (*Discestra*). Biscayne Bay (Sloss.).

Known only from Florida.

Morrisonia sectilis *Gn.* (*rileyana* Sm.). "Florida" (Sloss.).

Extends to Missouri and Texas.

Morrisonia mucens *Hbn.* St. Johns Bluff (Doubleday).

Extends to the Middle States, Missouri and Texas.

Morrisonia confusa *Hbn.* "Florida" (Sloss.).

Larva on willow.

Extends to Canada, Colorado and Texas.

Heliophila velutina *Sm.* (*lutina* Sm.; *Chabuata*). Biscayne Bay (Sloss.).

Known only from Florida.

Heliophila unipuncta *Haw.* (*Cirphis*). It is strange that I have been unable to find any records of the actual occurrence of this species in Florida. In the present instance I have deviated from my practice of omitting from this list species not recorded from the state. The army-worm is so extremely common to the north, south and west of Florida that I feel that I cannot pass it by unnoticed.

The larva is a general feeder on grasses and cereals.

Extends to Hudson Bay, Arizona and through Mexico and the Antilles to Chili and Argentina. Occurs also in Europe, Asia, Australia, Java, Japan, and the Canaries, Azores and island of Madeira.

Heliophila pilipalpis *Grt.* (*Cirphis*). Apalachicola (Thaxter, Schaus); Charlotte Harbor, Biscayne Bay (Sloss.).

Known only from Florida.

Heliophila latiuscula *H.-S.* (*subpunctata* Harv.; *Cirphis*). Hastings, Oct. 24 (A. M. N. H.); South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.).

Extends to Georgia, Texas and through Mexico and the Antilles to Brazil.

Heliophila pallens *Linn.* (*luteopallens* Sm.; *Leucania*). Archer, Mar. (Sm.).

Larva on grasses.

Extends to Canada and California. Occurs also in Europe and Asia.

Heliophila extincta *Gn.* (*ligata* Grt.; *Borolia*). "Florida" Mar. (Sm.); St. Johns Bluff (Doubleday); Hastings, Oct. 15 (A. M. N. H.); Lakeland, May 7 (Ds.).

Extends to Maine, Colorado and Mexico.

Heliophila linita *Gn.* (*Borolia*). St. Johns Bluff. (Doubleday); South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.).

Extends through the Atlantic States to Maine.

Heliophila juncicola *Gn.* (*Cirphis*). Indian River, Fort Myers, Mar. 30, Everglade, Apr. 6, 7 (A. M. N. H.); South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.).

Occurs from Alabama to Texas.

Heliophila multilinea *Wlk.* (*Cirphis*). Palm Beach, Miami (Dyar).

Extends through the Eastern States to Canada, and through the Antilles to Paraguay. Occurs also in Costa Rica and Guatemala, but has not yet been reported from Mexico.

Heliophila commoides *Gn.* (*Cirphis*). "Florida," Mar. (Sm.).

Extends to Nova Scotia, Washington and New Mexico.

Heliophila phragmitidicola *Gn.* (*Cirphis*). "Florida," Mar. (Sm.); Lake Worth (Dyar); Chokoloskee (Barnes).

Extends to Canada, California and New Mexico.

Heliophila pendens *Sm.* Chokoloskee (Sm.).

Known only from Florida.

Cirphis calpota *Sm.* Fort Myers (McD.).

Graphiphora culea *Gn.* (*Eriopyga*). "Florida" (Sloss.).

Extends to Massachusetts and Missouri.

Graphiphora oviduca *Gn.* (*Eriopyga*). "Florida" (Sm.).

Extends to Canada and Vancouver Island.

Graphiphora vindemialis *Gn.* (*Physetica*). "East Florida" (Doubleday).

Though described "from Florida" this species may not be American.

Copicucullia alfarata *Strck.* St. Augustine (Strecker).

Known only from Florida.

Bellura gortynoides *Wlk.* Mellonville (Hampson).

Larva in cat-tail (*Typha*).

Extends to Canada and Missouri.

Bellura melanopyga *Grt.* Lake Beresford (Comstock).

Larva bores in stalks of pond lily.

Known only from Florida.

Sphida obliqua *Wlk.* Fort Myers, not rare (McD.); Chokoloskee (Barnes).

Larva in *Typha latifolia.*

Extends to Massachusetts, Ontario and Colorado.

Sphida anoa *Dyar.* Miami (Hegen and Hendricksen).

Known only from Florida.

Nonagria oblonga *Grt.* (*Archanara*). Jacksonville, Sept. 28 (Ds.); Indian River (Grt.).

Extends to Maine and Buffalo. Occurs also in Jamaica.

Achatodes zeæ *Harr.* Fort Myers (McD.).

Larva on *Sambucus* (not *Zea* as has been recorded).

Extends to New York and Colorado.

Gortyna u-alba *Gn.* (*Phuphena*). Charlotte Harbor (Sloss.); Key West (Sm.).

Extends to Massachusetts and Minnesota.

Jodia rufago *Hbn.* "Florida" (Sloss.).

Extends to Massachusetts, Canada and Texas.

Fagitana obliqua *Sm.* (*Phuphena*). "Chokalo" (Sm.); Fort Myers, Apr. 22, 23 (A. M. N. H., Ds.).

Known only from Florida.

Fagitana littera *Gn.* "Florida" (Sloss., Doubleday).

Extends to Massachusetts, New York and Illinois.

Orthosia aurantiago *Gn.* (*Rhodœcia*). "Florida" (Sm.); [East Gainesville, Sept. 29].

Extends to New York, Wisconsin and Missouri.

Orthosia chlorophora *Hbn.* "Florida" (Sm.).

Known also from Georgia.

Epiglæa sericea *Morr.* (*venustula* Grt.; *Harpaglœa*). "Florida" (Sloss.).

Extends to Massachusetts and Wisconsin.

Epiglæa apiata *Grt.* "Florida" (Sloss.).

Extends to Massachusetts and Illinois.

Atethmis subusta *Hbn.* (*Bagisara*). Fort Myers (McD.), Mar. 30, Apr. 22 (A. M. N. H., Ds.); Everglade (McD.), Apr. 7 (A. M. N. H.); Chokoloskee (Barnes); Biscayne Bay (Sloss.); [Gainesville, Sept. 26, 27, 29; Fisherville, Pensacola, Oct. 11; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 15].

Extends to Texas and through Mexico and the Antilles to Argentina.

Chloridea virescens *Fabr.* Fort Myers, Apr. 22, Everglade, Apr. 10 (A. M. N. H.); Chokoloskee (Barnes); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Rhexia, Solanum sieglinge, Physalis viscosa* and tobacco.

Extends to Canada, California and through Mexico and the Antilles to Argentina.

Heliocheilus paradoxus *Grt.* (*Chloridea*). Jacksonville (Sloss.).

Extends through Texas to Colorado.

Heliocheilus albidentina *Wlk.* (*Chloridea*). "Florida" (Doubleday).

Known only from Florida.

Heliothis armigera *Hbn.* (*Chloridea*). Lakeland, Nov. 9 (Ds.); South Bay, Lake Okeechobee, Apr. 30, May 1 (A. M. N. H., Ds.); Everglade, Apr. 10 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on corn, cotton, tomatoes, *Rosa, Reseda* and *Calamintha.*

This species is world-wide, occurring throughout the United States and southern Canada and through Mexico and the Antilles to Chili; also in Europe, Asia, Africa, Australia, Japan and the Hawaiian and Canary Islands.

Rhodophora gauræ *S. and A.* La Belle, Apr. 27 (A. M. N. H.).

Larva on *Gaura biennis.*

Occurs also in Georgia and thence westward to Colorado.

Porrima sanguinea *Geyer.* (*Schinia*). "Central Florida" (Neumoegen).

Occurs in Texas.

Canidia scissa *Grt.* (*Heliothis*). "Florida" (*Grote*).

Known only from Florida.

Schinia trifascia *Hbn.* Hastings, Sept. 22, Oct. 3, 6, 7, 15 (A. M. N. H.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to New Jersey and Colorado.

Schinia arefacta *Hy. Edw.* "Florida" (Edwards).

Known only from Florida.

Schinia lynx *Gn.* "Florida" (Sm.).

Extends to Massachusetts, Missouri and Texas.

Schinia saturata *Grt.* "Florida" (Hampson).

Extends to Massachusetts and Southern California.

Schinia petulans *Hy. Edw.* "Florida" (Edw.).

Known only from Florida.

Schinia marginata *Haw.* (*Lygranthœcia*). [Gainesville, Sept. 26 and 27.

Extends to Massachusetts and Iowa.]

Schinia tuberculum *Hbn.* (*Lygranthœcia*). "Florida" (Sm.).

Extends through the Atlantic States to Pennsylvania.

Schinia meskeana *Grt.* (*Lygranthœcia*). "Florida" (Sm.).

Extends to Texas, New Mexico and Mexico.

Schinia espea *Sm.* "Miaco," Sept. (Sm.).

Known only from Florida.

Heliophana mitis *Grt.* "Florida" (Sloss.).

Extends to Texas.

Xanthopastis timais *Cram.* Ormond, larva (Sloss.); Indian River (A. M. N. H.); Punta Gorda (Sloss.); Fort Myers (McD.); Lake Worth (Dyar); Biscayne Bay (Sloss.).

Larva on *Pancratium rotatum.*

Extends to Maine (as a straggler) and through Mexico and the Antilles to Argentina.

Dr. Dyar recognizes four different kinds of larvæ to which he has applied names as follows: *regnatrix* Grt. for the North American form, *antillium* Dyar for the West Indian form, *moctezuma* Dyar for the Mexican form, and *amaryllidis* Sepp. for the South American form. The name *timais,* he says may be retained as a general name for the species and not applied to any larva.

Psychomorpha epimenis *Drury.* Charlotte Harbor (Sloss.).

Larva on *Vitis.*

Extends to New York, Kansas and Texas.

Psychomorpha euryrhoda *Hamps.* "Florida" (Doubleday).

Known only from Florida.

Euthisanotia unio *Hbn.* (*Eudryas*). Charlotte Harbor (Sloss.); Fort Myers, Apr. 22 (A. M. N. H., Ds.); South Bay, Lake Okeechobee, Apr. 29 (Ds.).

Larva on *Epilobium* and *Vitis.*

Extends through the Atlantic States to New York and Massachusetts.

Noropsis hieroglyphica *Cram.* "Florida" (Sm.).

Extends to Missouri, Texas and through Mexico and the Antilles to South America.

Cocoons of this species were common in Jamaica, attached to the trunks of cocoanut palms.

Acherdoa ferraria *Wlk.* "Central Florida" (Neumoegen); Charlotte Harbor, Punta Gorda, Feb. (Sloss.); Fort Myers (Mattes, McD.); La Belle, Apr. 27, 28 (A. M. N. H.); Biscayne Bay (Sloss.).

Known only from Florida.

Basilodes pepita *Gn.* "Florida" (Snow).

Extends to Virginia and Kansas.

Gonodonta unica *Neum.* Indian River (Neumoegen); Lake Worth (Dyar); South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.); Chokoloskee (Barnes).

Larva on *Anona laurifolia.*

Known only from Florida.

Gonodonta nutrix *Cram.* "Florida" (Dyar).

Extends through the Antilles to South America.

Plusia ærea *Hbn.* "Florida" (Smith).

Larva on *Verbena.*

Extends to Nova Scotia, Colorado and New Mexico.

Autographa verruca *Fabr.* Miami, Jan., Biscayne Bay (Sloss.); [Agric. Exp. Sta. grounds, Gainesville, Sept. 26].

Extends to New York, Kansas, Texas and through Mexico and the Antilles to South America.

Autographa ou *Gn.* Charlotte Harbor, Biscayne Bay (Sloss.); [Lake Miccosukee, Monticello, Oct. 6; De Funiak Springs, Oct. 17].

Extends to New York, Oregon, California, through Mexico and the Antilles to South America.

Autographa biloba *Steph.* "Florida" (Smith).

Larva on peony and *Eupatorium.*

Extends to Massachusetts, Quebec, California and Texas.

Autographa rogationis *Gn.* Indian River (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on wandering jew, *Geranium* and *Eupatorium.*

Extends to New York, Colorado and through Mexico and the Antilles to Brazil.

Autographa egena *Gn.* Indian River (Grote).

Described from Brazil.

Autographa brassicæ *Riley.* Fort Myers Apr. 1, 22, 23 (A. M. N. H., Ds.); Everglade Apr. 10; Chokoloskee, Apr. 8 (Ds.); Biscayne Bay (Sloss.); [Fisherville, Pensacola, Oct. 11; Lake Stanley, De Funiak Springs, Oct. 18].

The larva is a general feeder on cruciferous plants.

Occurs throughout the United States and Canada.

Autographa abrota *Druce.* "Florida" (Dyar).

Occurs in Mexico.

Autographa oxygramma *Geyer.* [Lake Stanley, De Funiak Springs, Oct. 18.

Extends to New Jersey, Missouri, Texas, and through the Antilles and Mexico to Brazil.]

Autographa basigera *Wlk.* Lake Worth (Sloss.); Fort Myers, Apr. 23 (A. M. N. H.).

Extends through the Atlantic States to New York. Occurs also in Mexico.

Diastema tigris *Gn.* Indian River (A. M. N. H.).

Extends through Mexico and Central America to Columbia and Venezuela.

Ogdoconta cinereola *Gn.* Lakeland, May 6 (A. M. N. H.).

Larva on ragweed.

Extends to Massachusetts, Quebec, Nebraska and Texas.

Pæctes devincta *Wlk.* Stemper, Sept. 15 (Marloff).

Extends through Mexico to Brazil.

Pæctes lunodes *Gn.* Lake Worth, Palm Beach (Dyar).

Larva on *Bursera gummifera.*

Extends through the Antilles to Brazil and Paraguay.

Pæctes abrostoloides *Gn.* St. Johns Bluff (Doubleday); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to Canada, Missouri and Mexico.

Pæctes pygmæa *Hbn.* Lake Worth, Biscayne Bay (Sloss.).

Larva on *Liquidamber styraciflua.*

Extends through Texas to New Mexico.

Pæctes oculatrix *Gn.* "Florida" (Sloss.).

Extends through the Eastern and Central States to Canada.

Eutelia pulcherrima *Grt.* "Florida" (Sloss.).

Hitherto specifically recorded only from New York and New Jersey.

Eutelia pyrastis *Hamps.* Miami (Schaus).

Occurs in the Bahamas.

Marasmalus basalis *Wlk.* (*ventilator* Grt.; *Marathyssa*). "Florida" (Sloss.).

Larva on poison ivy.

Extends to Massachusetts, Quebec, Nebraska, Colorado and Texas.

Marasmalus inficita *Wlk.* (*Marathyssa*). Fort Myers (McD.), Apr. 23, La Belle, Apr. 27 (A. M. N. H.).

Larva on poison ivy.

Extends to Quebec, Nebraska, Colorado and Texas.

Amyna octo *Gn.* (*orbica* Morr.). Everglade (McD.).

Extends to Kansas and through Mexico and the Antilles to Argentina. Occurs also in Asia, Africa, Australia, the Malay Archipelago and other islands of the South Pacific.

Pteræthòlix bullula *Grt.* (*Amyna*). Biscayne Bay (Sloss.).

Extends to Alabama, Texas and through Mexico to Guatemala.

Alabama argillacea *Hbn.* Indian River (A. M. N. H.); [Monticello, Oct. 4; Star Lake, Pensacola, Oct. 13; De Funiak Springs, Oct. 17].

Larva on cotton.

Extends to Massachusetts and Ontario as a migrant and through Mexico and the Antilles to Brazil.

Cosmophila erosa *Hbn.* (*Anomis*). Crescent City, Mar., larva (Riley); Lakeland, May 5, Fort Myers, Apr. 26, La Belle, Apr. 27 (A. M.

N. H.); South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.); Indian River (A. M. N. H.); Chokoloskee (Barnes); [Hogtown Creek, Gainesville, Oct. 1].

Larva on *Urena lobata, Abutilon avicennæ, Malva rotundifolia* and *Hibiscus.*

Extends to Massachusetts, Montreal, Kansas and through Mexico and the Antilles to South America. Occurs also in South Africa and in the Oriental and Australian regions.

Cosmophila texana *Riley* (*Anomis*). Chokoloskee (Barnes).

The determination of the specimens on which this record is based is somewhat doubtful.

Occurs in Texas.

Cosmophila xanthindyma *Bd.* (*serrata* B. and McD.; *Anomis*). Fort Meade, Apr. (Barnes).

Occurs in the Antilles, South America, South Africa and the Oriental and Australian regions.

Cosmophila doctorium *Dyar* (*Anomis*). Everglade, Apr. 9 (Ds.).

The specimen was determined by Dr. Dyar who recently revised the genus. It agrees with the types in wing shape, but in color more nearly with *exacta* Hbn. which has more even wing margins.

Occurs in the West Indies and Brazil.

Scolecocampa liburna *Geyer.* "Florida" (Sloss.).

Larva in decaying cherry, hickory, oak and chestnut stumps.

Extends to Canada and the Rocky Mountains.

Eucalyptera bipuncta *Morr.* "Florida" (Smith).

The larva "probably bores in reeds or grasses."

Extends along the Atlantic Coast to Massachusetts.

Eucalyptera humeralis *Sm.* Hastings, Apr., June, Sept., Oct. (Barnes and Kearfott).

Occurs in North Carolina.

Amolita fessa *Grt.* Fort Myers, Apr. 26 (A. M. N. H.); La Belle, Apr. 26, 27 (A. M. N. H., Ds.); Lake Worth (Dyar); Everglade (McD.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to Massachusetts and Texas.

Amolita sentalis *Kaye.* Hastings, Enterprise (Kearfott); Lakeland, Fort Myers (McD.).

Extends to Texas, Panama and Brazil. Occurs also in Trinidad.

Amolita roseola *Sm.* Hastings (Kearfott); Fort Myers (McD.).

Occurs in Texas.

Doryodes bistriaris *Geyer.* Lake Worth (Dyar); Punta Gorda, Nov. 5 (Ds.); Fort Myers (McD.), Mar. 30, 31, Apr. 23 (A. M. N. H.); Everglade, Apr. 6, 7, 9, 11, 14 (A. M. N. H., Ds.).

Larva on *Spartina juncea*.

Extends to Maine and Kansas.

Doryodes spadaria *Gn.* Atlantic Beach (Sloss.); Everglade (McD.).

Known only from Florida.

Except in size, I can find no definite marks of separation between this and the preceding species (McD.).

Phiprosopus callitrichoides *Grt.* "Florida" (Sloss.); [near De Funiak Springs (G. C. Fisher)].

Larva on *Smilax rotundifolia.*

Extends to New York and Texas.

Anepischetos bipartita *Sm.* Key West (Smith).

Known only from Florida.

Diallagma lutea *Sm.* "Florida," Sept. (U. S. N. M.); Archer, July 3 (Kœbele); Charlotte Harbor (Sloss.).

Known only from Florida.

Pleonectyptera pyralis *Hbn.* "Florida" (Smith).

Extends to Long Island and Texas.

Pleonectyptera geometralis *Grt.* "Florida," Mar. (Smith); La Grange, Sept. 12 (Ds.); Lakeland, May 4, 5, 8 (A. M. N. H., Ds.).

Extends through the Atlantic States to New York.

Pleonectyptera habitalis *Wlk.* Glenwood (A. M. N. H.); La Grange, Sept. 7 (Ds.); Lakeland May 5, 8 (Ds., McD.); Marco, Apr. 19, 20, 21 (A. M. N. H., Ds., McD.); Everglade Apr. 15 (A. M. N. H.); Miami, Sept. 21 (Sleight).

Extends to New York and Texas.

Pleonectyptera (?) **albocostaliata** *Pack.* "Florida" (Sloss.).

Extends to Massachusetts.

Eustrotia flaviguttata *Grt.* "Florida" (Hampson).

Occurs in Texas.

Eustrotia apicosa *Haw.* (*Lithacodia*). St. Johns Bluff (Doubleday); Lakeland, May 4, Fort Myers, Apr. 22 (Ds.); South Bay, Lake Okeechobee, Apr. 29 (A. M. N. H.); Biscayne Bay (Sloss.).

Extends to Massachusetts, Quebec, Missouri and Cuba.

Eustrotia strigulataria *Sm.* Lakeland, May 8 (Ds.); Fort Myers (McD.), Apr. 22 (A. M. N. H.).

Known only from Florida.

Galgula partita *Gn.* Lakeland, May 4, La Belle, Apr. 27 (A. M. N. H.).

Extends to Canada, California and through Mexico to Central America. Occurs also in the Antilles, Azores, Canaries, Madiera and ? Spain.

Lithacodia bellicula *Hbn.* "Florida" (Sloss.).

Extends to Nova Scotia and Colorado.

Prothymia rhodarialis *Wlk.* "Florida," Mar. (Smith); Hastings, Sept. 21, Oct. 3, Lakeland, May 5, 8 (A. M. N. H.); Punta Gorda, Nov. 11 (Ds.); Fort Myers (McD.), Apr. 1, 2, 23, 26, La Belle, Apr. 27, Marco, Apr. 18, Allen River to Deep Lake, Apr. 12 (A. M. N. H., Ds.); Everglade (McD.); Chokoloskee (Barnes).

Extends to Massachusetts and Texas.

Prothymia semipurpurea *Wlk.* Charlotte Harbor (Sloss.); Fort Myers, Apr. 21 (A. M. N. H.); [Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14].

Extends to Massachusetts and Texas.

Exyra semicrocea var. **hubbardiana** *Dyar.* De Funiak Springs (Hubbard).

Larva on *Sarracenia variolaris* and *S. flava.*

The typical form is reported from the Middle and Central States to as far north as New Jersey.

Xanthoptera nigrofimbria *Gn.* Enterprise (Hamps.); Lakeland, May 4, 5, Fort Myers, Apr. 22, 24 (A. M. N. H., Ds., McD.); La Belle, Apr. 27 (Ds.); Allen River to Deep Lake, Apr. 14 (A. M. N. H.); [East Gainesville, Sept. 28; Gainesville, Oct. 2].

Extends to New York, Missouri, Texas and Mexico.

Xanthoptera semiflava *Gn.* (*Tarachidia*). Lakeland (McD.), May, 4, 5, 7, 8 (A. M. N. H., Ds.); [Gainesville (Coll. Agric. Exp. Sta.); Crestview, Oct. 15].

Extends to New Jersey, Colorado and Texas.

Thalpochares ætheria *Grt.* (*Hyperstrotia*). Enterprise, Tampa (Hampson).

Known only from Florida.

Eumestleta obliqualis *Fabr.* (*flammicincta* Wlk.; *Eublemma*). Lake Worth (Dyar); Fort Myers, Apr. 24 (A. M. N. H.); Everglade, Apr. 7 (A. M. N. H., Ds., McD.); Marco (McD.); Chokoloskee (Barnes); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to Alabama, Texas and through Mexico and the Antilles to Peru.

Eumestleta cinnamomea *H.-S.* (*laphyra* Druce; *Eublemma*). Everglade (McD.).

The specimen agrees with Hampson's figure and Druce's figure (Biol. Centr. Am. Het., Pl. 96, f. 2.). Close to *obliqualis* but with the median line much less oblique (McD.).

Extends through Mexico and the Antilles to Uruguay.

Eumestleta minima *Gn.* (*carmelita* Morr.; *Eublemma*). Lakeland, May 4 (A. M. N. H.); Fort Myers (McD.).

Extends through the southern United States to California. Also reported from St. Thomas, Brazil, Argentina and Cape Colony.

Tyrissa multilinea *B. and McD.* Everglade (McD.).

Occurs in Texas.

Acidalioides eoides *B. and McD.* Everglade (McD.).

Known only from Florida.

Proroblemma testa *B. and McD.* Everglade, Apr. 1–7 (McD.).

Known only from Florida.

Sigela basipunctaria *Wlk.* (*Pseudocraspedia*; *Eois*). "East Florida" (Doubleday); La Grange, Sept. 7 (Ds.); Egmont, Apr. 20, Palm Beach (A. M. N. H.); Everglade, Apr. 6 (Ds.).

Occurs in the Antilles.

Sigela penumbrata *Hulst.* Archer, Mar. 4, 9, 21, Apr. (Koebele).

Has been reported from California.

Tripudia quadrifera *Zell.* (*Cobubatha*). Enterprise (Sloss.).

Extends to Texas and through Mexico and the Antilles to British Guiana and Colombia.

Cobubatha numa *Druce.* South Bay, Lake Okeechobee, May 1 (A. M. N. H.), May 2 (Ds.).

Occurs in Mexico and thence to Colombia.

Cobubatha olivacea, new species.

Expanse, 11.5 mm. Head and thorax brown with many evenly scattered grayish scales, the posterior part of latter and apical ends of patagia yellow; abdomen dark brown. Primaries clear olive green, basal area brown with a few grayish scales, outer edge rounded and slightly irregular; median fascia rather broad, defined outwardly by a reddish-brown sinuous line, inwardly diffuse, with a scattering of silvery white lines on each side; subterminal shade rather narrow, brownish, diffuse inwardly, bent in before costa. Outer margin and fringe blackish-brown with whitish scales disposed in transverse lines. Apex black, preceded on costa by a white mark. Secondaries dark brown, outer half of fringe gray, the whole of fringe separated from rest of wing by a pale line. Beneath, primaries brown, inner margin whitish, costa marked with yellow spots, outer margin blackish, preceded by intervenular yellow spots; secondaries rather finely mottled with brown and yellow, terminal line blackish, broken, fringe brown.

Described from one male taken at Marco, April 17.

The species is evidently closely allied to *C. goyanensis* Hamps. described from Argentina, but is of an olive rather than rufous color. For *goyanensis* also no mention is made of any yellow on the thorax, a most pronounced character and there are minor differences in maculation, chiefly of the underside.

Type: In the American Museum.

Metaponia obtusa *H.-S.* (*Stiriodes*). New Smyrna (Sloss.); Fort Myers (McD.); La Belle, Apr. 26 (Ds.); Biscayne Bay (Sloss.).

Extends to New Jersey and Texas.

Chamyris cerintha *Treit.* "Florida" (Hamps.).

Larva on plum, apple and *Prunus serotina.*

Extends to Massachusetts, Canada and Kansas.

Tarache terminimaculata *Grt.* Charlotte Harbor (Sloss.); Fort Myers (McD.); South Bay, Lake Okeechobee, Apr. 29, May 2 (A. M. N. H., Ds.); Biscayne Bay (Sloss.).

Extends to New York and Illinois.

The specimens from Okeechobee differ from the typical form in some respects, particularly in the more or less smoky hind wings; but the differences probably come within the range of variation of the species.

Tarache delecta *Wlk.* "Florida" (Smith).

Larva on *Hibiscus moscheutos.*

Extends to Long Island and Texas.

Tarache aprica *Hbn.* (*biplaga* Gn.). "Florida" (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Variety **ceyvestensis** *Dyar.* Key West (Dyar).

Extends to Montreal, New Mexico and Honduras.

Tarache tetragona *Wlk.* (*quadriplaga* Sm.). Biscayne Bay (Sloss.).

Extends to New Mexico, Mexico and the Antilles.

Tarache candefacta *Hbn.* (*Tarachidia*). St. Johns Bluff (Doubleday); Enterprise (Hampson); Lakeland (McD.); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Ambrosia artemisiæfolia.*

Extends to Massachusetts, Canada, Washington, California and Mexico.

Tarache tenuscens *Sm.* (*Tarachidia*). Lake Worth (Sloss.).

Known only from Florida.

Fruva fasciatella *Grt.* (Dyar 2696, syn.). Everglade (McD.).

Extends through Texas to Arizona.

Fruva apicella *Grt.* (*Heliocontia*). Tallahassee (Koebele, A. M. N. H.).

Larva on "yellow brown-weed."

Extends to North Carolina, Missouri and through Mexico to Colombia. Occurs also in Jamaica.

Fruva parvula *Wlk.* (*Tarachidia*). Fort Myers (McD.).

Occurs in Georgia.

Spragueia onagrus *Gn.* Tallahassee, Jacksonville, Sept. 7, La Grange, Sept. 11 (Ds.); Enterprise (Hampson); Lakeland, Fort Myers (McD.); La Belle, Apr. 28 (A. M. N. H.); [Gainesville, Sept. 26 and Oct. 2; Monticello, Oct. 5].

Extends to New Jersey, Missouri and Texas.

Spragueia leo *Gn.* "Florida" (Hampson).

Extends to New Jersey and Texas.

Spragueia dama *Gn.* (*transmutata* Wlk.). "Florida" (Hampson);

Hastings (A. M. N. H.); [Gainesville, Sept. 26 and Oct. 2; Monticello, Oct. 5].

Extends to Texas and through Mexico to Guatemala. Occurs also in the Antilles.

Callopistria floridensis *Gn.* (*Eriopus*). Jacksonville, Nov. 3, Indian River (A. M. N. H.); Orlando, July 10 (Russell); Fort Myers (McD.); South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.); Chokoloskee (Barnes); Biscayne Bay (Sloss.).

Larva on fern.

This species has recently occurred, as a pest in greenhouses, as far north as Washington, D. C., and Illinois. Its normal range is not further north than Florida, but southward it extends through Mexico and the Antilles to Brazil.

Methorasa argentilinea *Wlk.* (*Eriopus*). Lakeland, May 5 (A. M. N. H.).

Extends through the Middle and Central States.

Methorasa monetifera *Gn.* (*Eriopus*). "Florida" (Hampson). It is probable that this record refers to the following species.

Extends to Nova Scotia.

Methorasa cordata *Ljung.* (*Eriopus*). Lakeland, May 7 (A. M. N. H.).

Extends to South Carolina and the Antilles.

Euherrichia mollissima *Gn.* (*Eriopus*). "Florida" (Sloss., Maynard).

Extends to Canada and Colorado.

Euherrichia granitosa *Gn.* "Florida" (Smith).

Known only from Florida.

Hormoschista pagenstecheri *Moesch.* Hastings, Oct. 27 (A. M. N. H.); Chokoloskee (Barnes).

The determination of the specimen on which the Barnes record is based is somewhat doubtful.

Extends to North Carolina, Mississippi and the Antilles.

Pangrapta decoralis *Hbn.* Lakeland, May 5, 6, 8, Fort Myers, Apr. 1, 7, 26 (A. M. N. H., Ds., McD.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to Nova Scotia and Texas.

Sylectra erycata *Cram.* Florida (Dyar, Smith); Chokoloskee (Barnes).

Extends through the Gulf States and into South America.

Hyamia perditalis *Wlk.* Citrus Center, May 2 (A. M. N. H., Ds.); Everglade (McD.).

Extends to Massachusetts and New Mexico.

Homopyralis contracta *Wlk.* Everglade, Apr. 6 (Ds.).

Extends to Canada and Texas.

Homopyralis tantillus *Grt.* "Florida," Mar. (Smith); Charlotte Harbor (Sloss.).

Extends to New York and Texas.

Homopyralis monodia *Dyar.* Hastings, Oct. 15 (A. M. N. H.); Everglade, Apr. 5 (Ds.); Cocoanut Grove (Schwarz).

Occurs in the "South Atlantic States."

Hypsoropha monilis *Fabr.* "Florida" (Sloss.); Island Grove (Seifert).

Larva on *Diospyros virginiana.*

Extends to Missouri.

Hypsoropha hormos *Hbn.* "Florida" (Sloss.); Lakeland, May 5 (A. M. N. H.).

Extends to New York and Texas.

Hyblæa puera *Cram.* "Florida" (Smith).

Extends to Texas and the Antilles.

Drasteria erechtea *Cram.* [Gainesville (Coll. Agric. Exp. Sta.).

Food plants: grass, clover, etc.

Extends to Canada and California.]

Cænurgia convalescens *Gn.* Pablo Beach, Sept. 5 (Ds.); Glenwood, July (Barnes); Indian River (A. M. N. H.); Lakeland, May 4, 5, 7, 8, Fort Myers, Apr. 1, 2, 23, 25, La Belle, Apr. 27 (A. M. N. H.); Lake Worth, Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.); Devils Mill Hopper, Gainesville, Sept. 27; Monticello, Oct. 5 and 7; Fisherville, Pensacola, Oct. 11; Bayou Chico, Pensacola, Oct. 12; Star Lake, Pensacola, Oct. 13; De Funiak Springs, Oct. 17 and 19; Lake Stanley, De Funiak Springs, Oct. 18].

Extends to Canada and Missouri.

Panula inconstans *Gn.* Charlotte Harbor (Sloss.).

Occurs in the "Southern States," Missouri and Texas.

Panula remigipila *Gn.* "East Florida" (Doubleday).

Known only from Florida.

Melipotis limbolaris *Geyer.* "Florida" (Smith).

Extends to New Hampshire, Quebec and Wisconsin.

Melipotis jucunda *Hbn.* La Grange, Sept. 12 (Ds.); Indian River (A. M. N. H.); Lakeland, May 5 (Ds.); Belleair (Sloss.); Fort Myers (McD.), Mar. 31, South Bay, Lake Okeechobee, May 2, Marco, Apr. 17 (A. M. N. H.).

Extends to New York, Colorado and Texas.

Melipotis famelica *Gn.* Chokoloskee (Barnes).

Melipotis sinualis *Harv.* Miami, Sept. 23 (Sleight).

Extends to Texas and through Mexico to Colombia.

Syneda graphica *Hbn.* Charlotte Harbor (Sloss.).

Variety **media** *Morr.* Belleair (Sloss.).

Extends to Massachusetts.

Syneda faceta *Hy. Edw.* "Florida" (Smith); Indian River (Edw.).

Known only from Florida.

Catocala epione *Drury* (*Mormonia*). [Gainesville (Coll. Agric. Exp. Sta.).

Food plants: oak and hickory.

Extends to Canada, Missouri and Iowa.]

Catocala sappho *Strck.* (*Catabapta*). Tallahassee (A. M. N. H.); end of Apr. (Koebele); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to Missouri and Texas.

Catocala vidua *S. and A.* (*Catabapta*). "Florida" (Smith).

Larva on oak, hickory and walnut.

Extends to Canada.

Catocala cara *Gn.* "Florida" (Smith).

Larva on willow and poplar.

Extends to Canada and Texas.

Catocala amatrix *Hbn.* (*Mormonia*). "Florida" (Smith).

Larva on willow and poplar.

Extends to Nova Scotia, Colorado, Arizona and Mexico.

Catocala coccinata *Grt.* (*Ephesia*). St. Johns River (A. M. N. H.).

Variety **sinuosa** *Grt.* Lakeland, May 5 (A. M. N. H.).

Larva on oak.

Extends to Canada, Illinois and Texas.

Catocala ultronia *Hbn.* (*Ephesia*). "Florida" (Koebele).

Variety **celia** *Hy. Edw.* Indian River (A. M. N. H.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on apple, plum, wild cherry, dogwood and oak.

Extends to Canada and Colorado.

Catocala ilia *Cram.* Lakeland (McD.), Mar. 31, La Belle, Apr. 27, 28 (A. M. N. H., Ds.).

Larva on oak.

Extends to Canada and Missouri.

Catocala muliercula *Gn.* (*Catabapta*). Lakeland, May 5 (A. M. N. H.); Seven Oaks, May 24, very abundant (Thurston).

In all five examples collected, the ground color is black rather than brown as in the typical form and the subreniform is white.

Larva on wax myrtle.

Extends to Connecticut and New Mexico.

Catocala clintoni *Grt.* "Florida" (A. M. N. H.).

Extends to Canada and Texas.

Catocala cratægi *Saund.* (*polygama* Gn.; *Ephesia*). "Florida" (Smith).

Larva on thorn.

Extends to Canada and Arizona.

Catocala amasia *S. and A.* (*cordelia* Hy. Edw.; *Ephesia*). Tallahassee (A. M. N. H.).

Larva on oak.

Extends to New York and Kansas.

Catocala similis *Edw.* (*Ephesia*). Lakeland, two specimens inclining toward var. *isabella* Hy. Edw. (McD.).

Larva on oak.

Extends to Rhode Island and Texas.

Catocala micronympha *Gn.* (*Ephesia*). Lakeland, May 4, 5, La Belle, Apr. 27, 28, common (A. M. N. H., Ds.).

Variety **ouwah** *Poling.* La Belle, Apr. 27, 28 (A. M. N. H., Ds.).

Variety **hero** *Hy. Edw.* "Florida" (A. M. N. H.).

Variety **gisela** *Meyer.* La Belle, Apr. 28 (A. M. N. H., Ds.).

Larva on live, burr and other oaks.

Extends to Canada and California.

Catocala alabamæ *Grt.* (*Ephesia*). "Florida" (A. M. N. H.).

Extends to New Mexico.

Catocala amica *Hbn.* (*Corisce*). Lakeland, May 4, 5, 6, 7, 8, common (A. M. N. H., Ds., McD.); South Bay, Lake Okeechobee, Apr. 30, May 2 (A. M. N. H.).

Variety **androphila** *Gn.* Lakeland, May 6, 7 (A. M. N. H., Ds.); La Belle, Apr. 28 (A. M. N. H., Ds.); South Bay, Lake Okeechobee, May 2 (A. M. N. H.).

Variety **suffusa** *Beut.* Lakeland, May 7 (A. M. N. H., Ds.).

Larva on *Quercus.*

Extends to Massachusetts, Illinois and Texas.

Catocala jair *Strck.* Indian River district (Doll).

Hampson makes this a variety of the preceding species.

Has been taken in New Jersey.

Allotria elonympha *Hbn.* "Florida" (Hamps.).

Larva on *Glycine* and walnut.

Extends to New York.

Hypocala andremona *Cram.* "Florida," June (Smith).

Extends to New York, Texas and South America.

Phoberia atomaris *Hbn.* Biscayne Bay (Sloss.).

Extends to Massachusetts and Texas.

Siavana repanda *Wlk.* Ortega, Sept. 6 (Ds.); Suwanee Springs, Apr. 15 (Sloss.); La Grange, Sept. 10 (Sleight); Indian River, Lakeland, May 5 (A. M. N. H.); Useppa (Ds.); La Belle, Apr. 28 (A. M. N. H., Ds.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends to Kentucky.

Panapoda rufimargo carneicosta *Gn.* Suwanee Springs, Apr. 15, Biscayne Bay (Sloss.).

Larva on oak, basswood, hickory and willow.

Extends to Quebec and Texas.

Parallelia bistriaris *Hbn.* "Florida" (Smith); Lakeland (McD.).

Larva on *Acer rubrum* and *A. dasycarpum.*

Extends to Nova Scotia and Colorado.

Agnomonia anilis *Drury.* [One specimen at light, Gainesville, Oct. 2. Extends to New York, Missouri and Texas.]

Remigia repanda *Fabr.* "Florida," Mar., Aug. (Smith); Jacksonville, Sept. 7 (Ds., Sleight), Nov. 5 (A. M. N. H.); La Grange, Sept. 10, 12 (Ds., Sleight); Lakeland, May 5, 7, 9 (A. M. N. H., Ds.); Charlotte Harbor (Sloss.); Punta Gorda, Nov. 15, Fort Myers, Apr. 3, 22, 26, 30, South Bay, Lake Okeechobee, Apr. 29, 30, Punta Rassa, Apr. 3, Nov. 12, 13, 15, Everglade, Apr. 8 (A. M. N. H., Ds.); Lake, Worth (Dyar); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30; Gainesville, Sept. 27; Star Lake, Pensacola, Oct. 13; Lake Stanley, De Funiak Springs, Oct. 18; De Funiak Springs, Oct. 18; near De Funiak Springs (G. C. Fisher)].

Variety **disseverans** *Wlk.* Chokoloskee (Barnes).

Variety **marcida** *Gn.* South Bay, Lake Okeechobee, May, 2 (A. M. N. H.); Miami, Sept. 21 (Sleight); Biscayne Bay (Sloss.); [Monticello, Oct. 5; De Funiak Springs, Oct. 18 and 19].

Larva on *Cenchrus.*

Extends to Labrador, the Rocky Mountains, and through Mexico and the Antilles to South America.

Grammodes smithii *Gn.* (*Parallelia*). Tallahassee.

Occurs in the Southern States.

Epidromia delinquens *Wlk.* Indian River, Fort Myers (McD.), Apr. 20, 23 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville, Oct. 2].

Extends through Mexico and Central America to South America.

Poaphila quadrifilaris *Hbn.* Lakeland, May 8 (A. M. N. H.); Fort Myers (McD.), Apr. 1, 2, 23, 29, 30 (A. M. N. H., Ds.).

Larva on *Gossypium.*

Extends through the Atlantic States to Massachusetts.

Poaphila deleta *Gn.* Charlotte Harbor (Sloss.); Fort Myers, Mar. 30, 31, Apr. 1, 2, 24, La Belle, Apr. 27, South Bay, Lake Okeechobee, May 2, Marco, Apr. 20 (A. M. N. H., Ds.).

Occurs in the Southern States.

Poaphila sylvarum *Gn.* Jacksonville (Sloss.).

Larva on *Andromeda ferruginea.*

Occurs in the Southern States.

Poaphila erasa *Gn.* Biscayne Bay (Sloss.).

Occurs in the Southern States.

Poaphila herbicola *Gn.* "Florida" (Sloss.).

Occurs in the Southern States.

Poaphila contempta *Gn.* "Florida" (Smith).

Occurs in Georgia.

Poaphila pacalis *Wlk.* Biscayne Bay (Sloss.).

Known only from Florida.

Poaphila turbata *Wlk.* "East Florida" (Doubleday).

Known only from Florida.

Phurys vinculum *Gn.* La Grange, Sept. 11, 12 (Ds.); Hastings, Oct. 4, Titusville, Nov. 8, Indian River (A. M. N. H.); Lakeland, May 4, 5, 7, 8 (Ds.); Punta Gorda, Feb. (Sloss.); Nov. 17 (A. M. N. H.); Fort Myers (McD.), Apr. 1, 21, 23, 24, La Belle, Apr. 27, South Bay, Lake Okeechobee, May 2, Marco, Apr. 21 (A. M. N. H., Ds.); Chokoloskee (Barnes); Biscayne Bay (Sloss.); [Gainesville, Oct. 3; Monticello, Oct. 5; Lake Miceosukee, Monticello, Oct. 6; Bayou Chico, Pensacola, Oct. 12].

Occurs in Georgia.

Phurys bistrigata *Hbn.* Charlotte Harbor (Sloss.).

Occurs in Georgia.

Phurys lima *Gn.* [Gainesville (Coll. Agric. Exp. Sta.).

Extends through the Southern and Gulf States.]

Phurys perspicua *Wlk.* "Florida" (Smith); [Lake Miceosukee, Monticello, Oct. 8].

Known only from Florida.

Phurys campanilis *Sm.* Chokoloskee (Smith).

Known only from Florida.

Anticarsia gemmatilis *Hbn.* Jacksonville, Sept. 7, Nov. 2, 5, Pablo Beach, Nov. 4 (A. M. N. H., Ds.); Hastings, Oct. 23, 24, Enterprise, Nov. 9, Indian River, Titusville, Nov. 8 (A. M. N. H.); Fort Myers, Nov. 15, South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.); Chokoloskee (Barnes); Lake Worth, Biscayne Bay (Sloss.); [common, Agric. Exp. Sta. grounds, Gainesville, Sept. 26 and 30; Devils Mill Hopper, Gainesville, Sept. 27; Gainesville, Sept. 27; Gainesville, Aug. to early Jan., Winterhaven, Polk Co., June 30, Tavares, Lake Co., July 1, Miami, July (J. R. Watson).

Larva on velvet bean, kudzu vine and horse bean (J. R. Watson).]

Extends to Staten Island, Wisconsin, Texas and through Mexico and the Antilles to South America.

Anticarsia ferruginea *Sm.* Lake Worth (Sloss., Dyar, A. M. N. H.); Useppa, Apr. (Ds.); Dry Tortugas (A. M. N. H.).

Larva on *Canavalia obtusifolia.*

Occurs in the Bahamas.

Antiblemma inexacta *Wlk.* Indian River, Lakeland, May 8, Fort Myers, Apr. 24 (A. M. N. H.).

Variety **minorata** *Sm.* "Florida," Apr., June (Hulst); Glenwood (Barnes); Lake Worth (Sloss.).

Extends to New York, Arizona and South America.

Litoprosopus futilis *G. and R.* Indian River (A. M. N. H.); Charlotte Harbor, Punta Gorda, Feb. (Sloss.); Useppa, Apr. (Ds.); Lake Worth (Sloss.); Chokoloskee (Barnes).

Occurs in Georgia.

Ophideres apta *Wlk.* (*materna* Linn.). "Florida" (Sloss.).

Extends southward through Mexico into South America.

Campometra amella *Gn.* Enterprise (Sloss.); Indian River (A. M. N. H.); Punta Gorda, Feb. (Sloss.); South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends through Texas to Colorado.

Campometra mima *Harv.* "Florida" (A. M. N. H.).

Extends to Colorado and Arizona.

Campometra cinctipalpis *Sm.* Cocoanut Grove (Schwarz).

Known only from Florida.

Trama detrahens *Wlk.* "Florida" (Sloss.), Mar. (Smith).

Extends to Texas.

Trama hinna *Geyer.* "Florida," Mar. (Smith); Punta Gorda, Feb. (Sloss.); [Lake Miceosukee Monticello, Oct. 6].

Extends to Georgia and Texas.

Massala larina *Druce.* Fort Myers, Apr. 23, Marco, Apr. 19, Everglade, Apr. 15, 22 (A. M. N. H.); Everglade, Apr. 5 (Ds.).

Described from Guatemala. Our specimens agree with examples in the National Museum under this name though they are somewhat darker than the type.

Capnodes punctivena *Sm.* Charlotte Harbor (Sloss.); Lake Worth (Dyar).

Larva on *Eugenia*, probably *E. buxifolia.*

Known only from Florida.

Capnodes rufinans *Gn.* Everglade (McD.), Apr. 10, 15 (A. M. N. H., Ds.); Allen River to Deep Lake, Apr. 14 (Ds.).

Occurs in Jamaica, Brazil and Honduras.

Kakopoda cincta *Sm.* Everglade (McD.); Chokoloskee, common (Barnes); Biscayne Bay (Sloss.).

Known only from Florida.

Egryrlon filaria *Sm.* Biscayne Bay (Sloss.).

Known only from Florida.

Zale horrida *Hbn.* [East Gainesville, Sept. 28.

Extends to Canada and the Rocky Mountains.]

Selenis monotropa *Grt.* Biscayne Bay (Sloss.).

Extends to Texas.

Pseudanthrœcia coracias *Gn.* Indian River (A. M. N. H.); Fort Myers (McD.), Apr. 23, La Belle, Apr. 27 (Ds.); Biscayne Bay (Sloss.).

Extends to Canada and New Mexico.

Phæocyma exhausta *Gn.* Chokoloskee, July (Smith).

Extends through Mexico and Central America into South America. Occurs also in Santo Domingo.

Phæocyma fictilis *Gn.* Egmont, Apr. 29, Marco, July (Smith).

Extends to Texas and into South America. Occurs also in the Antilles.

Phæocyma viridans *Gn.* Marco, Miami (Smith).

[Occurs in Mexico, Central and South America.]

Phæocyma lunata *Drury.* Enterprise (Sloss.); South Bay, Lake Okeechobee, Apr. 30 (Ds.).

Larva on maple, willow, rose, wild cherry and plum.

Extends to Canada, the Rocky Mountains, Arizona and through Mexico to Argentina.

Phæocyma edusina *Harv.* Punta Gorda, Feb. (Sloss.).

Occurs in Texas and is doubtfully reported from Kentucky and New York.

Phæocyma undularis *Drury.* "Florida" (Sloss.).

Extends to Canada, Colorado and Mexico.

Phæocyma æruginosa *Gn.* "Florida" (Smith).

Extends to Canada and to the Mississippi River.

Phæocyma obliqua *Gn.* "Florida" (Smith).

Extends to New York and the Mississippi River.

Phæocyma curema *Sm.* Seven Oaks, Sept., Palm Beach, Mar. (Smith).

Extends to New York and Missouri.

Phæocyma benesignata *Harv.* Indian River (Smith); Punta Gorda, Feb. (Sloss.).

Extends to Canada.

Phæocyma cingulifera *Wlk.* "Florida" (Smith).

Extends to Maine and Wisconsin.

Phæocyma sexplagiata *Wlk.* Miami (Schaus).

Occurs in the Antilles and South America.

Phæocyma calycanthata *S. and A.* Indian River (A. M. N. H.).

Larva on *Calycanthus floridus.*

Known also from Georgia and North Carolina.

Phæocyma declarans *Wlk.* "East Florida" (Doubleday).

Known only from Florida.

Latebraria amphipyroides *Gn.* "Florida" (A. M. N. H.).

Occurs in Texas and in South America.

Erebus odora *Linn.* South Bay, Lake Okeechobee, Apr. 27 (A. M. N. H., Ds.).

Larva on *Cassia fistula, Pithecolobium* and *Saman.*

Extends to Canada as a straggler, Colorado, California, and through Mexico and the Antilles to Chili and Paraguay.

Peosina pandrosa *Cram.* Miami (Dyar).

Occurs in the Antilles, Panama and South America.

Thysania zenobia *Cram.* "Florida" (Smith).

Extends to New York, as a straggler, and Colorado, and through Mexico and the Antilles to Brazil.

Epizeuxis americalis *Gn.* Hastings (A. M. N. H.).

Larva on sweet clover and *Hedysarum* and has been bred from larvæ found in ants' nests.

Extends to Canada and New Mexico.

Epizeuxis lubricalis *Geyer.* Chokoloskee, Apr. 8 (A. M. N. H.).

Larva on grasses and decayed wood.

Extends to Nova Scotia, Colorado and Texas.

Epizeuxis scobialis *Grt.* Hastings (A. M. N. H.).

Extends through the Atlantic and Central States to New York.

Epizeuxis æmula *Hbn.* "Florida" (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.); Monticello, Oct. 7].

Larva on *Phlox,* spruce and dead leaves.

Extends to Canada and Colorado.

Epizeuxis gopheri *Sm.* "Florida" (Hubbard).

Larva in the burrows of the gopher tortoise.

Known only from Florida.

Zanclognatha lituralis *Hbn.* "Florida" (Smith).

Extends to Canada and Texas.

Hypenodes macula *Druce.* Fort Myers, Everglade (McD.); Apr. 6 (A. M. N. H.).

"We possess two similarly marked specimens from South California which are, however, considerably larger." (McD.).

Described from Panama.

Sisyrhypena orciferalis *Wlk.* Charlotte Harbor (Sloss.); Everglade, common (McD.), Apr. 6, 9, 11 (A. M. N. H.).

Extends to New York, Illinois and Texas.

"All the Everglade specimens are very dark, some being almost black with very faint maculation." (McD.). This statement applies also to the Museum specimens taken in the same locality.

Renia salusalis *Wlk.* Hastings, Mar. (A. M. N. H.); Enterprise, Apr. (Castle and Laurent).

Extends to New Jersey and Colorado.

Renia fraternalis *Sm.* Archer, Feb. (Smith); Glenwood (A. M. N. H.); Rockledge, Apr. (Smith); Everglade (McD.).

Extends to New Jersey.

Renia sobrialis *Wlk.* South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.).

Extends to Nova Scotia.

Variety **larvalis** *Grt.* "Florida," Mar. (Smith).

Extends to New York, Texas and Colorado.

Hypenula cacuminalis *Wlk.* "Florida," Apr. (Smith); Indian River (A. M. N. H.); Charlotte Harbor (Sloss.); Miami, Sept. 21 (Sleight).

Extends to New Jersey and Texas.

Bleptina caradrinalis *Gn.* Hastings, Mar., Lakeland, May 9 (A. M. N. H.); Useppa, Apr. (Ds.); Lake Worth (Dyar).

Extends to Canada, British Columbia and Arizona.

Bleptina inferior *Grt.* Hastings, Oct. 19, Lakeland, May 5, 7 (A. M. N. H.).

Variety **medialis** *Sm.* Jacksonville (Sloss.); Lakeland (McD.), May 4, 5, Nov. 1 (Ds.); Cocoanut Grove (Schwarz).

Extends to New Jersey and Texas.

Tetanolita palligera *Sm.* (*floridana* Sm.). Archer, Mar. 30, Apr. (Smith); Hastings, Oct. 25, 28, Lakeland, Mar. 28, La Belle, Apr. 27, South Bay, Lake Okeechobee, May 1, Apr. 29 (A. M. N. H.).

Extends to New Jersey and California.

Tetanolita mynesalis *Wlk.* "Florida," Jan., Oct. 19 (A. M. N. H.); Fort Myers (McD.); Everglade (McD.), Apr. 15 (A. M. N. H.).

Extends to Canada, Illinois and Texas.

Gaberasa ambigualis *Wlk.* Lakeland, May 6 (A. M. N. H.); Charlotte Harbor (Sloss.); Everglade, Apr. 5, 6 (A. M. N. H., Ds.).

Extends to Canada and Texas.

Dircetis pygmæa *Grt.* La Belle, Apr. 28 (A. M. N. H.); Everglade (McD.), Apr. 9, 10 (A. M. N. H.).

Occurs in Texas.

Palthis asopialis *Gn.* Lakeland, Mar 28 (A. M. N. H.), Nov. 9 (Ds.); Lake Worth, common at light (Dyar); Everglade (McD.); Apr. 7, 9, 10 (A. M. N. H., Ds.).

Extends to Canada and Missouri.

Salia interpuncta *Grt.* "Florida" (Sloss., Schwarz).

Extends to Massachusetts and Arizona.

Lomanaltes eductalis *Wlk.* Fort Myers (McD.).

"The specimen is smaller and darker than the more northern form." (McD.).

Extends to Nova Scotia and Minnesota.

Bomolocha manalis *Wlk.* Lake Worth (Dyar); Fort Myers (McD.), Apr. 23, Citrus Center, May 2, South Bay, Lake Okeechobee, Apr. 29, 30, May 1 (A. M. N. H., Ds.).

Extends to Canada and Minnesota.

Bomolocha baltimoralis *Gn.* Fort Myers, Apr. 22 (A. M. N. H.).

Larva on maple and *Baptisia tinctoria.*

Extends to Nova Scotia and the Central States.

Bomolocha bijugalis *Wlk.* "Florida" (Smith).

Extends to Canada, Washington and Texas.

Bomolocha citata *Grt.* Fort Myers (McD.); Everglade, Apr. 8 (A. M. N. H.).

Extends to New York , Illinois and Texas.

Bomolocha umbralis *Sm.* "Florida" (Smith).

Known only from Florida.

Plathypena scabra *Fabr.* [Gainesville (Coll. Agric. Exp. Sta.); Lake Miceosukee, Monticello, Oct. 6.

Larva on clover.

Extends to Canada, the Rocky Mountains and Texas.]

Hypena ancara *Druce.* Fort Myers, Apr. 22 (Ds.).

Described from Guatemala.

PERICOPIDÆ.

Composia fidellissima *H.-S.* Indian River (Dyar); Lake Worth (Sloss., Dyar); Palm Beach, Dec., larva (Dyar); Miami, Jan., Biscayne Bay (Sloss.); Key West (French, Dyar).

Larva on *Echites umbellata, Canavalia* and cultivated oleander. Eggs have been found on *Vincetoxicum scoparium.*

Extends through the Antilles and Central America to Brazil.

NOTODONTIDÆ.

Apatelodes torrefacta *S. and A.* "Florida" (Edw.).

Variety **floridana** *Hy. Edw.* "Florida" (French); Indian River (A. M. N. H.).

Larva on willow, sassafras, ash, alder, blackberry, hazel, ironwood, gallberry, *Azalia, Viburnum, Prunus virginiana* and *Phaseolus.*

Extends to Massachusetts, Wisconsin, Missouri and Texas.

Apatelodes angelica *Grt.* Enterprise (Thaxter).

Variety **indistincta** *Hy. Edw.* Indian River (A. M. N. H., Neumoegen).

Larva on ash and *Syringa.*

Extends to Ontario and Ohio.

Melalopha inclusa *Hbn.* Jacksonville (Packard); Indian River (Edwards).

Variety **jocosa** *Hy. Edw.* Indian River (Edwards).

Larva on *Populus* and *Salix.*

Extends to Canada, Nebraska, Colorado and Texas.

Datana integerrima *G. and R.* Fort Myers, Apr. 22 (A. M. N. H.); Apr. 23 (Ds.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Juglans,* hickory, beach, oak, willow, honey locust, thorn and apple.

[Extends over the Atlantic States.]

Datana floridana *Graef.* "Florida" (Graef, French), March (U. S. N. M.), larvæ, Oct. (U. S. N. M.).

Larva on *Andromeda mariana.*

Known only from Florida.

Datana modesta *Beut.* "Florida" (Graef, French); Kissimmee, May (Dyar, Palm); [Agric. Exp. Sta. grounds, Gainesville, Sept. 30].

Known only from Florida.

Hyperæschra georgica *H.-S.* "Florida" (U. S. N. M.).

Larva on *Quercus.*

Extends to Maine, Wisconsin and Colorado.

Lophodonta angulosa *S. and A.* "Florida" (Strecker).

Larva on *Quercus.*

Extends to Maine, Illinois, Arkansas and Texas.

Eunystalea indiana *Grt.* Indian River (Grote).

Known only from Florida.

Symmerista albifrons *S. and A.* Charlotte Harbor (Sloss.).

Larva on *Quercus* and beech.

Extends to Maine, Kansas and Texas.

Dasylophia anguina *S. and A.* "Florida" (Packard).

Variety **puntagorda** *Sloss.* Punta Gorda (Sloss.).

Larva on locust, clover, *Lespedeza capitata* and *Baptisia tinctoria.*

Extends to Maine, Wisconsin, Colorado and Texas.

Litodonta hydromeli *Harv.* Punta Gorda, Charlotte Harbor (Sloss.); Key West (Schwarz).

Larva on *Bumelia angustifolia.*

Known also from Texas.

Heterocampa lineata *Druce.* "Florida?" (Dyar).

Known from Mexico.

Heterocampa astarte *Doub.* St. Johns Bluff (Doubleday); Biscayne Bay (Sloss.).

Larva on *Quercus. Q. nigra* has been specifically recorded.

Extends to Georgia and Texas.

Heterocampa obliqua *Pack.* Enterprise, Winter Park (Sloss.).

Larva on *Quercus macrocarpa.*

Extends to Massachusetts and Kansas.

Heterocampa picta *Feld.* Apalachicola (Chapman); Fort Myers, Mar. 30 (A. M. N. H.).

Known only from Florida.

Heterocampa umbrata *Wlk.* Pablo Beach, Nov. 4 (Ds.); Punta Gorda, Charlotte Harbor (Sloss.).

"A larva found on body of white oak fed on *Quercus alba* and *Q. coccinea.*" (Packard).

Extends to Rhode Island and Illinois.

Heterocampa subrotata *Harv.* Punta Gorda (Sloss.).

Extends to New York, Illinois, Arkansas and Texas.

Heterocampa biundata *Wlk.* Winter Park (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on red and sugar maple, fire cherry, yellow birch, white birch, willow, witch hazel, dogwood, beech and hickory.

Extends to Massachusetts, Illinois, and Central America.

Heterocampa guttivitta *Wlk.* St. Johns Bluff, Mar., Apr. (Doubleday); Fort Myers (McD.).

Larva on sugar maple, red maple, oak, apple, chestnut, beech and *Viburnum.*

Extends to Maine, Wisconsin, Iowa and Colorado.

Schizura ipomœæ *Doub.* Ortega, Sept. 6 (Ds.).

Larva on *Ipomœa coccinea, Quercus, Acer, Betula, Ulmus, Vaccinium, Ceanothus,* honey locust and blackberry.

Extends to Canada, Washington and Arizona.

Schizura concinna *S. and A.* "Florida" (Slosson, Palm); Lakeland, larvæ, May 6, adults, June 12–18 (A. M. N. H.).

Larva on *Hicoria, Salix, Populus, Prunus, Rubrus, Cratægus, Pyrus, Malus, Cornus florida, Liquidamber styraciflua, Diospyros virginiana, Halesia tetraptera, Myrica cerifera, Betula, Vaccinium, Wisteria,* rose, snowdrop, apricot, oak and locust.

Extends to Maine, Canada, Missouri and Texas.

Schizura semirufescens *Wlk.* Biscayne Bay (Sloss.).

Larva on *Salix, Populus, Betula,* maple, beech and apple.

Extends to Maine, New Hampshire and British Columbia.

Schizura apicalis *G. and R.* Charlotte Harbor (Sloss.).

Extends to Maine and Arkansas.

Hyparpax perophoroides *Strck.* Punta Gorda, Feb., Charlotte Harbor (Sloss.); Fort Myers, Mar. 31, Apr. 1, 23 (A. M. N. H., Ds.).

Variety **tyria** *Sloss.* Charlotte Harbor (Sloss.); Fort Myers (McD.).

Occurs in Texas.

Cerura scitiscripta *Wlk.* Jacksonville (Sloss.); Indian River (A. M. N. H.).

Larva on willow, poplar, wild cherry and pomegranate.

Extends to New York, Missouri, Texas and Mexico.

Harpyia borealis *Bd.* Ormond (Sloss.).

Larva on *Prunus.*

Extends to Maine, Wisconsin and Missouri.

Harpyia cinerea *Wlk.* "Florida" (Sloss.).

Larva on willow and poplar.

Extends to Canada, the Pacific Coast and through Mexico to Guatemala.

Fentonia marthesia *Cram.* Indian River, opposite Micco, larva (Jenks); Biscayne Bay (Sloss.).

Larva on *Quercus* and beech.

Extends to Maine, Texas and through Mexico to Brazil and Surinam.

THYATIRIDÆ.

Euthyatira candida *Sm.* "Florida" (Sloss.).

Known only from Florida.

LIPARIDÆ.

Hemerocampa inornata *Beut.* Anastasia Island, Enterprise, May (A. M. N. H.); Fort Myers (McD.), Apr. 22, 26, adults, Allen River to Deep Lake, larvæ (A. M. N. H., Ds.); Everglade, Apr. 10 (A. M. N. H.). A common species in some parts of Florida.

Larva on *Quercus virens* and cypress.

Dyar says he obtained a *Hemerocampa* larva on Long Island which produced *inornata.* Verification of the determination, however, is desirable.

[Extends over the Atlantic States.]

Olene basiflava meridionalis *B. and McD.* "Florida," Aug. 15 (A. M. N. H.); "Hogart Land" (Barnes & McD.); Tallahassee, Apr. 30 (A. M. N. H.); Lakeland, May 10 (A. M. N. H.), June 1–7 (McD.); Island Grove, May 7, from which a second brood was raised in the north, July 20–Aug. 3. Mrs. Slosson's record of *achatina* S. and A. probably refers to this form. [Gainesville (Coll. Agric. Exp. Sta.).]

Larva on *Quercus* and *Hicoria.*

Extends to North Carolina. The typical form occurs from Maryland to Massachusetts.

Olene atomaria parallela *G. and R.* Tallahassee (Koebele).

Barnes and McDunnough in their revision of *Olene,* say that the record for this locality requires confirmation. The typical form occurs with the variety.

Larva is reported as occurring on *Quercus, Castanea, Hicoria,* wild cherry, plum and pear.

Extends to New Hampshire and (?) Nebraska.

Olene manto *Strck.* Hastings, May (Barnes & McD.); Fort Meade, Feb. (Dorner).

Larva on *Abies frazeri, A. mariana* and *Pinus.*

Extends to North Carolina.

Olene leucophæa S. and A., *cinnamomea* G. and R. and *plagiata* Wlk. have been recorded from Florida, but according to Barnes and McDunnough, these species do not occur there.

LASIOCAMPIDÆ.

Artace punctistriga *Wlk.* Lakeland, May 7 (A. M. N. H.); Fort Myers, Apr. 23, Nov. 12 (A. M. N. H.), May 3 (Ds., McD.); Biscayne Bay (Sloss.).

Larva on oak.

Extends to New Jersey.

Tolype minta *Dyar.* Hastings (Dyar); Fort Myers, Mar. 24–30 (Ds.), Apr. 23 (A. M. N. H.). Cocoons were found on pine trees.

Known only from Florida.

Malacosoma americana *Fabr.* "Florida" (Dyar).

Larva on *Fraxinus, Quercus,* wild cherry, hawthorn, apple and other fruit trees.

Extends through the Atlantic States to Canada.

PLATYPTERYGIDÆ.

Oreta odona *Strck.* "Florida" (Strecker).

Known only by the type.

GEOMETRIDÆ.

Ametris nitocris *Cram.* (*Mecoceras*). Indian River (A. M. N. H., Grote); Lake Worth (Sloss., Dyar); Chokoloskee (Barnes); Miami, Sept. 21 (Sleight), 23 (Ds.); Biscayne Bay (Sloss.).

Larva on *Coccoloba floridana.*

Occurs in Mexico and thence into South America.

Almodes terraria *Gn.* Cocoanut Grove (Hulst.); Miami, Sept. 23 (Ds.); Biscayne Bay (Sloss.).

Occurs in the Antilles and probably in Mexico.

Racheospila lixaria *Gn.* St. Johns Bluff (Doubleday); Belleair, Charlotte Harbor (Sloss.); Fort Myers, Apr. 16–23 (McD.); Biscayne Bay (Sloss.).

Extends to Tennessee.

The species has been recorded from New Jersey as occurring in the larval stage on *Myrica,* but it is doubtful whether this record really refers to *lixaria.* The same may be said of the record of its occurrence in Arizona.

Racheospila extremaria *Wlk.* (Dyar 3571, syn.). Leesburg, Sept. 26 (Engelhardt); Fort Myers (McD.).

Larva on wax myrtle.

Extends through the Atlantic States to Montreal.

Racheospila rubrolinearia *Pack.* (Dyar 3571, syn.). Fort Myers, Apr. 16–23 (McD.).

Larva on *Myrica cerifera.*

Extends through the Atlantic States to Pennsylvania.

Racheospila catachloa *Hulst* (*Aplodes*). Belleair, Charlotte Harbor (Sloss.); Fort Myers, Apr. 23, Mar. 31 (Ds.), May 1–7 (McD.).

Known only from Florida.

Racheospila gerularia *Hbn.* (*xysteraria* Hulst; *Synchlora*). Fort Myers, Apr. 16–23, May 1–7 (McD.); Marco, Apr. 17 (A. M. N. H.); Biscayne Bay (Sloss.).

Extends through the Antilles to Brazil.

Racheospila sitellaria *Gn.* (*hulstiana* Dyar; *Synchlora*). Lake Lucy, Jan. 30 (A. M. N. H.); Lake Worth (Dyar); Marco, Apr. 17, Everglade, Apr. 6 (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on *Lantana camara.*

Occurs in the Antilles.

Racheospila cupidenaria *Grt.* (*Aplodes*; Dyar 3571, syn.). Enterprise, May 24 (Schwarz); Everglade, Apr. 1–7 (McD.); Cocoanut Grove (U. S. N. M.); Biscayne Bay (Sloss.); Dry Tortugas, June 7–13 (Wickham).

Occurs in the Bahamas.

Racheospila atrapes *Druce* [Homestead, May 14 (Castle).

Described from Panama.]

Nemoria mimosaria *Gn.* (*Aplodes*). "Florida" (Prout).

Larva on *Quercus.*

Extends to Canada and Missouri.

Synchlora ærata *Fabr.* Fort Myers, Apr. 1 (A. M. N. H.); Apr. 22 (Ds.).

Larva on *Rubus, Aster, Rudbeckia* and *Spiraea.*

Extends to Canada and Alberta.

Synchlora denticularia *Wlk.* Lake Worth (Dyar); La Belle, Apr. 27, Fort Myers, Apr. 1, 2, Marco, Apr. 20 (A. M. N. H., Ds.); Everglade, Apr. 8, 11, 14, 18, 19, 21, 23 (A. M. N. H., Ds., McD.); Biscayne Bay (Sloss.).

Larva on *Bidens* and *Solidago.*

Extends to (?) Canada and Texas. Occurs also in the Bermudas.

Phrudocentra centrifugaria *H.-S.* (*jaspidiaria* Hulst, *hollandaria* Hulst, *viridipurpurea* Hulst; *Racheospila*). St. Johns River (Holland);

Indian River (A. M. N. H.); Lake Worth (Hulst); Charlotte Harbor (Sloss.); Fort Myers (Mattes); Marco, Apr. 17 (A. M. N. H.); Everglade, Apr. 1–7 (McD.).

Occurs in Cuba.

Dichorda iridaria *Gn.* (*Anaplodes*). Tallahassee (A. M. N. H.); Charlotte Harbor, Cocoanut Grove (Sloss.).

Larva on sumac.

Extends to Massachusetts, Texas and Mexico. The Californian records for this species refer to *Dichorda rectaria* Grt.

Chlorissa pistaceata *Gn.* (*Nemoria*). Florida (Sloss.).

Extends to Massachusetts.

Chlorissa subcroceata *Wlk.* (*auranticolorata* Strck., dyarii Hulst; *Nemoria*). "Florida" (Sloss.); Whitfield (Strecker).

Larva on *Quercus coccinea.*

Extends to Massachusetts.

Chlorochlamys chloroleucaria *Gn.* St. Johns Bluff (Doubleday); Orlando, Apr. 1 (Pearsall); Lake Lucy, Mar. 5 (A. M. N. H.); Lakeland, May 4, 5, 6, La Belle, Apr. 27 (A. M. N. H., Ds.); Fort Myers, Apr. 16–23, Everglade, Apr. 7, Apr. 16–23 (A. M. N. H., McD.).

Larva on *Ambrosia, Rubus, Helenium autumnale, Eupatorium perfoliatum, Achillea millefolium, Leucanthemum vulgare, Helianthus* and *Aster.* McDunnough adds *Bidens.*

Extends to Canada and California.

Chloropteryx tepperaria *Hulst.* "Florida" (Slosson).

Extends to North Carolina.

Eueana niveociliaria *H.-S.* (*saltusaria* Hulst; *Racheospila*). St. Johns River (Holland); Indian River (Neumoegen, Edwards, Hulst); Lake Worth (Sloss., Dyar).

Occurs in the Antilles.

Eucrostes dominicaria *Gn.* (*Synchlora*). "Florida" (Dyar).

Occurs in the Antilles.

Euacidalia sericeata *Pack.* "Florida" (Sloss.).

Extends to Arizona.

Pleuroprucha insulsaria *Gn.* (*Deptalia*). "East Florida" (Doubleday); Jacksonville, Nov. 3 (Ds.); Daytona, Sept. 10 (Engelhardt); Inverness, Nov. 18, Titusville, Nov. 8 (A. M. N. H.); Lakeland, Nov. 9 (Ds.); Tampa, Sept. 22 (Engelhardt); Punta Gorda, Nov. 16 (Ds.); Fort Myers, Apr. 24–30 (McD.), Nov. 12, 15 (A. M. N. H.); South Bay, Lake Okeechobee (A. M. N. H.).

Larva on *Galium, Quercus, Cassia chamæcrista, Celastrus scandens* and, in South America, *Prosopis* and *Acacia riparia.*

Extends to Massachusetts, Texas and Argentina.

Cosymbia myrtaria *Gn.* Daytona, Sept. 10 (Engelhardt); Fort Myers, May 1–7 (McD.), May 22 (Ds.); South Bay, Lake Okeechobee, May 1 (A. M. N. H.); Everglade, Apr. 8–15 (McD.), Apr. 10 (A. M. N. H.).

Larva on *Comptonia asplenifolia, Vaccinium* and *Gaylussacia.*

Extends to New York and Colorado.

Synelys enucleata *Gn.* "East Florida" (Doubleday).

Larva on *Vaccinium, Galium, Rhexia lutea, Prunus* and *Pyrus.*

Extends to Canada, Alberta and Texas.

Synelys nigrocandida *Hulst.* Jacksonville, Ormond (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends through the Atlantic States to New Jersey.

Synelys timandrata *Wlk.* "East Florida" (Doubleday); Jacksonville (Sloss.); Daytona, Sept. 10 (Engelhardt).

Known only from Florida.

Synelys subquadrata *Gn.* (*Cinglis compensata* Wlk.). "East Florida" (Doubleday); Jacksonville (Sloss.); Daytona, Sept. 10 (Engelhardt); Rockledge, Apr. (Hill); Lake Worth (Sloss., Dyar); Fort Myers, Apr. 24, 25 (A. M. N. H.), Apr. 24–30 (McD.); La Belle, Apr. 28, South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.).

Extends to Texas and through Mexico to Argentina.

Synelys umbilicata *Gn.* Lakeland, May 8 (Ds.); Fort Myers, Apr. 1–7, Apr. 24–May 7 (McD.); La Belle, Apr. 27 (A. M. N. H.).

Extends to Texas and through Mexico and the Antilles to Venezuela.

Scelolophia pannaria *Gn.* Lakeland, May 1–7 (McD.), Nov. 9 (Ds.); Charlotte Harbor (Sloss.); Fort Myers, Apr. 16–30, May 1–7 (McD.), May 1 (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on cow pea.

Extends to New Jersey, the Antilles, Mexico and Costa Rica.

Scelolophia purpurascens *Hulst* (*Eois*). Cocoanut Grove, Miami (U. S. N. M.).

Known only from Florida.

Scelolophia rubrotincta *Hulst* (*Wauchula*). Florida (Sloss.); Lake Worth (Dyar); Palm Beach, Mar. or Apr. (Hulst.).

Known only from Florida.

Scelolophia crossii *Hulst* (*Eois*). Florida (Dyar); Fort Myers, Apr. 16–23 (McD.).

Larva on *Lantana odorata.*

Occurs in the Bermudas and the Antilles.

Cinglis albidula *Hulst.* Jacksonville, Apr. 20 (Sloss.); Fort Myers, Apr. 24–30, Everglade, Apr. 8–15 (McD.); "South Florida" (Sloss.).

Know only from Florida.

Leptomeris lautaria *Hbn.* Tallahassee (Koebele); Jacksonville (Sloss.); Pablo Beach, Nov. 4 (A. M. N. H.; Daytona, Sept. 10 (Engelhardt); Enterprise (Hulst), Apr. (Castle and Laurent); Lake Lucy, Jan. 8, Feb. 15 (A. M. N. H.); Lakeland, May 5, 7 (A. M. N. H., Ds.); Charlotte Harbor (Sloss.); Lake Worth (Dyar); Fort Myers, Apr. 16–30 (McD.), Apr. 19 (A. M. N. H.); La Belle, Apr. 27 (A. M. N. H.); Everglade, Apr. 1–7 (McD.); Marco, Apr. 19 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville, Sept. 26 & Oct. 2; East Gainesville, Sept. 28; Monticello, Oct. 5 & 8; De Funiak Springs, Oct. 17 & 18; Lake Stanley, De Funiak Springs, Oct. 18].

Occurs in Georgia.

Leptomeris roseotincta *Hulst.* Everglade, Apr. 6 (A. M. N. H.); Biscayne Bay (Sloss.).

Known only from Florida.

Leptomeris æmulata *Hulst.* Lake Lucy, June 8 (A. M. N. H.); Lakeland, May 1–7 (McD.), May 8 (A. M. N. H.); Charlotte Harbor, Mar. (Sloss.); Fort Myers, Apr. 23, 25 (A. M. N. H.), Apr. 24–30, May 1–7 (McD.); La Belle, Apr. 26, 27 (A. M. N. H., Ds.); Everglade, Apr. 1–7 (McD.), Apr. 6 (A. M. N. H.).

Known only from Florida.

Leptomeris ostentaria *Wlk.* "East Florida" (Doubleday).

Occurs in Texas.

Leptomeris plantagenaria *Hulst.* "Florida" (Dyar).

Extends to Arizona.

Eois parvularia *Hulst.* Marco, Apr. 16–23 (McD.), Apr. 17 (A. M. N. H.).

Extends to Texas.

Eois scintillaria *Hulst.* "Florida" (Beutenmüller).

Known only from Florida.

Eois demissaria *Hbn.* Jacksonville (Sloss.); Lakeland, May 1–7 (McD.), May 4 (A. M. N. H.); Everglade, Apr. 8–15 (McD.).

I have never seen this species from any point north of Georgia or west of Texas. *E. ferrugata* Pack. which is found in the North Atlantic States and *russata* Hulst which is a form of it is not a synonym of *demissaria* Hbn., nor is *bonifata* Hulst with its variety *eremiata* Hulst a synonym. Both these species are distinct from *demissaria* Hbn. and from each other. *Inclusaria* Wlk. from East Florida (Doubleday) however, appears to be the same as Hübner's species.

Eois davisi, new species.

Expanse, 22–26 mm. Palpi, frons and base of antennæ pinkish brown, vertex white. Wings and body soiled whitish with a very faint yellowish cast, silky. Primaries crossed by three fine dusky lines, the first one-third out, evenly excurved except for a slight indentation on the anal vein, the second and third in outer area excurved on costa and thence running wavedly to inner margin. Terminal line brownish, fringes somewhat darker than wings. Discal dot vaguely showing, dusky. Secondaries with two waved dusky extradiscal lines which correspond to the two outer lines of primaries. Terminal line and fringes as in primaries. Discal spot elongate, dusky, sometimes quite distinct. Beneath whitish, silky. Costa on basal half brownish pink. Outermost line of above brown very fine and emphasized on the veins; sometimes only the dots on the veins are noticeable. Other lines of above and rarely even the outer line of primaries absent.

Five females, four of them taken at Marco, Apr. 17 and 20, by Mr. Wm. T. Davis after whom the species is named and one taken at Everglade in Apr. by Dr. J. McDunnough.

Apparently very closely allied to *Eois suavata* Hulst; it is paler and lacks much of the red color described for that species.

A cotype has been deposited in the Museum.[1]

Eois hilliata *Hulst.* Rockledge, Apr. (Hill).

Known only from Florida.

Eois lævitaria *Hbn.* Jacksonville (Sloss.); Lakeland, May 7 (A. M. N. H.); Fort Myers, Apr. 16–May 7 (McD.); La Belle, Apr. 7 (A. M. N. H.); Allen River to Deep Lake, Apr. 12, 14 (A. M. N. H., Ds.); Everglade, Apr. 1–15 (McD.).

Extends to Texas. It has also been recorded from California but I am inclined to doubt this record.

Eois peralbata *Pack.* Jacksonville, Biscayne Bay (Sloss.).

Extends to Arizona.

Eois nimbicolor *Hulst.* Florida, May (Hulst); Lakeland, May 1–7 (McD.).

Eois ossularia *Hbn.* "East Florida" (Doubleday); Lakeland, May 6, 7 (A. M. N. H.); Fort Myers, Apr. 16–May 7 (McD.), Apr. 24 (A. M. N. H.); La Belle, Apr. 27, 28 (A. M. N. H.); Lake Worth (Dyar).

Larva on *Galium* and strawberry.

Extends to New York and California.

Eois lanceolata *Hulst.* "Florida" (Dyar).

Extends to Southern California.

Eois balistraria *Gn.* Fort Myers, Apr. 24 (A. M. N. H.); Lake Worth (Dyar).

Extends to Colorado and Arizona.

Eois eburneata *Gn.* "East Florida" (Doubleday); Cocoanut Grove (U. S. N. M.).

---

[1] After Mr. Grossbeck's death the material with which he was working was carefully gone over. The specimens upon which this description was based could not be found and have not yet been located. The description is given, however, as Mr. Grossbeck wrote it and it is possible that the original specimens may yet be found.

Extends through Mexico to Argentina.

Eois suavata *Hulst.* Lake Worth (Sloss.); Palm Beach (Dyar); Marco, Apr. 17, 20 (Ds.); Everglade, Apr. (McD.).

Larva on *Randia aculeata.*

Known only from Florida.

Eois lacteolata *Lint.* Lake Lucy, Feb. 15 (A. M. N. H.); Lakeland, May 1–7 (McD.), May 7 (A. M. N. H.).

Extends to Texas.

Eois obfusaria *Wlk.* East Florida (Doubleday).

Occurs in Texas.

Eois micropterata *Hulst.* Hastings, May (Hulst); Lakeland, May 5, Allen River to Deep Lake, Apr. 14 (A. M. N. H.).

Known only from Florida.

Eois australis *Hulst.* "Florida" (Dyar).

Extends to Pennsylvania and Long Island.

Eois refractaria *Wlk.* "East Florida". (Doubleday).

Known only from Florida.

Emmiltis sparsaria *Wlk.* East Florida (Doubleday); La Belle, Apr. 27 (Ds.).

Occurs in Texas.

Dyspteris abortivaria *H.–S.* "Florida" (Sloss.).

Larva on grape.

Extends through the Atlantic States to Massachusetts.

Eudule meridiana *Sloss.* Winter Park (Sloss.); Lakeland, May 8 (Ds.); Tampa, Charlotte Harbor (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Extends through the Atlantic States to New Jersey.

Eupithecia miserulata *Grt.* (*nebulosa* Hulst). Jacksonville, Nov. 8 (A. M. N. H.); Crescent City, Apr. 9–14 (Packard).

Larva on *Rhexia virginica, Solidago, Geranium* and cranberry. *Juniperus* and *Quercus* have also been recorded by Packard but probably in error.

Extends to Canada and California.

Cysteophora pervertipennis *Hulst.* Lake Worth, Mar. or Apr. (Dyar).

Known only from Florida.

Orthonana obstipata *Fabr.* (*fluviata* Hbn.; *Percnoptilota*). Lake Worth (Sloss., Dyar).

Larva on *Ulmus* and *Polygonum.* In Europe it is also known to feed on *Senecio.*

An almost cosmopolitan species; unknown only in the Arctic regions, Australia, New Zealand and Chili.

Orthonana ceutrostrigaria *Wlk.* (*latirupta* Wlk.; *Hydriomena*). Lake Lucy, Feb. 12 (A. M. N. H.).

Larva on *Polygonum aviculare.*

Extends to Canada, California and through Mexico and the Antilles to Brazil; occurs also in the Azores and the Canaries.

Hydriomena floridata *Wlk.* "East Florida" (Doubleday).

Known only from Florida.

Hydriomena neomexicana *Hulst.* Lake Worth, Biscayne Bay (Sloss.).

Extends to Colorado and California.

Hydriomena australata *Hulst.* Indian River (Edwards).

Known only from Florida.

Cœnocalpe parinotata *Zell.* Indian River (A. M. N. H.); Lake Worth (Sloss., Dyar); Charlotte Harbor (Sloss.); Everglade, Apr. 8–15 (McD.); South Bay, Lake Okeechobee, Apr. 29 (Ds.); Biscayne Bay (Sloss.).

Extends to Texas.

Camptogramma (?) **stellata** *Gn.* (*Gypsochroa*). Daytona, Sept. 10 (Engelhardt); Indian River (A. M. N. H.); Lakeland, Nov. 9 (Ds.); Tampa, Sept. 22 (Engelhardt); Lake Worth (Dyar); Charlotte Harbor (Sloss.); Fort Myers, May 1–7, Apr. 16–23, Apr. 22, Everglade, Apr. 16–30 (A. M. N. H., Ds., McD.); Miami, Sept. 18 (Engelhardt), Sept. 23 (Ds.); [Gainesville, Sept. 26 & Oct. 2; Hogtown Creek, Gainesville, Oct. 2; Monticello, Oct. 5, 6, 8; Star Lake, Pensacola, Oct. 13; Big Bayou, Pensacola, Oct. 14; Crestview, Oct. 16; Lake Stanley, De Funiak Springs, Oct. 18; very common at light, De Funiak Springs, Oct. 17, 18, 19].

Larva on *Pisonia aculeata* and *Phytolacca.*

Extends to New Jersey, Texas and through Mexico and the Antilles to Argentina.

Eustroma diversilineata *Hbn.* Fort Myers, Apr. 16–23 (McD.), Apr. 25 (A. M. N. H.); [De Funiak Springs, Oct. 19].

Larva on *Vitis, Ampelopsis, Ulmus, Pyrus, Prunus, Rosa* and *Quercus imbricaria.*

Extends to Massachusetts, Canada and Colorado.

Episemasia morbosa *Hulst.* Hastings (A. M. N. H.).

Known only from Florida.

Sciagraphia granitata *Gn.* "East Florida" (Doubleday).

Larva on spruce and *Ribes.*

Extends to Nova Scotia, to British Columbia and California.

Sciagraphia continuata *Wlk.* "East Florida" (Doubleday); Ormond (Sloss.); Lakeland, May 6 (A. M. N. H.).

Larva on *Juniperus virginiana.*

Extends to Canada and Texas. The western records for this species refer to another species, *excurvata* Pack.

Macaria infimata *Gn.* Fort Myers, Apr. 16–23 (McD.); Everglade, Apr. 6 (A. M. N. H.).

Extends through the Atlantic States to Massachusetts.

Macaria æquiferaria *Wlk.* East Florida (Doubleday); Hastings (A. M. N. H.); Fort Myers, Apr. 16–23 (McD.), Apr. 22 (A. M. N. H., Ds.); Marco, Apr. 21, Allen River to Deep Lake, Apr. 12, 14, Everglade, Apr. 6, 7, 8, 10, very common at light (A. M. N. H., Ds.).

It is doubtful whether this species occurs north of the Southern States; all the specimens that I have seen from more northern regions being referable to *bisignata* Wlk. The southwestern form likewise seems to be *bisignata* rather than *æquiferaria,* though this may be distinct from both. The species has also been recorded from Mexico.

Macaria præatomata *Haw.* "Florida" (Sloss.); [Monticello, Oct. 4 and 5].

Larva on *Vaccinium.*

Extends through the Atlantic States to Canada.

Macaria punctolineata *Pack.* (*simulata* Hulst; *Sciagraphia*). Hastings, May, Marco Apr. 19 (A. M. N. H.); Everglade, Apr. 24–30 (McD.); Chokoloskee (Barnes).

Extends to Texas, and according to Dyar occurs in Arizona also.

Macaria maculifascia *Hulst* (*aucillaria* Strck.; *Sciagraphia*). "Florida" (Doll).

Extends to New Jersey, South Dakota and Texas.

Cymatophora cervinaria *Blanch.* Lakeland, May 6, La Belle, Apr. 27, Deep Lake, Apr. 13 (Ds.).

Extends to Arizona and through the Antilles to South America.

Cymatophora nicetaria *Gn.* "Florida" (Hulst).

Occurs in Haiti.

Cymatophora solitaria *Wlk.* "East Florida" (Doubleday).

Known only from Florida.

Cymatophora nervata *Gn.* "Florida" (Hulst).

Occurs in Brazil.

Cymatophora latiferrugata *Pack.* (*pustularia* Auct.). "East Florida" (Doubleday); Lake Lucy, Feb. 12, Mar. 5, Lakeland, May 4 (A. M. N. H.).

Larva on *Prunus pennsylvanica* and *Pyrus.*

Extends to Canada, British Columbia and Texas.

Cymatophora particolor *Hulst.* Lake Worth (Sloss.).

Known only from Florida.

Cymatophora floridensis *Hulst.* Enterprise, Apr. (A. M. N. H., Ill. State Lab.); Charlotte Harbor (Sloss.); Fort Myers, Apr. 25 (A. M. N. H.); " South Florida " (Rautenberg).

Known only from Florida.

Cymatophora abbreviata *Wlk.* Lake Worth (Dyar); Marco, Apr. 19 (A. M. N. H.); Everglade, Apr. 13 (A. M. N. H.), Apr. 16–23 (McD.).

Occurs in Georgia.

Cymatophora bicolorata *Fabr.* " Florida " (Hulst).

This species has also been reported from Virginia, Pennsylvania, Alberta, British Columbia and California. The specimens on which these records are based may be conspecific but it is still doubtful as to what *bicolorata* really is.

Cymatophora distribuaria *Hbn.* " Florida " (Sloss.).

Variety **transitaria** *Wlk.* " East Florida " (Doubleday); Hastings, May 5 (A. M. N. H.).

Extends through the Atlantic States to Maine.

Apolema carata *Hulst.* " Florida " (Hulst).

Known only from Florida.

Apæcasia deductaria *Wlk.* " Florida " (Sloss.).

Extends through the Atlantic States to Maine.

Apæcasia extremaria *Wlk.* " East Florida " (Doubleday).

Extends through the Atlantic States to New Jersey.

Catopyrrha coloraria *Fabr.* Jacksonville (Sloss.).

Form **dissimilaria** *Hbn.* " East Florida " (Doubleday); Lakeland, May 8 (A. M. N. H.).

Larva on *Trifolium* and raspberry.

Extends through the Atlantic States to Canada.

Catopyrrha sphæromacharia *Harv.* Hastings, May (A. M. N. H.); Enterprise (Sloss.); Deep Lake, Apr. 13 (Ds.); Allen River to Deep Lake, Apr. 14 (A. M. N. H.).

Variety **perolivata** *Hulst.* " Florida " (Sloss.).

Extends to Georgia, Arkansas and Texas.

Caripeta angustiorata *Wlk.* var. **latiorata** *Wlk.* " East Florida " (Doubleday).

Larva on *Pinus strobus.*

This variety is not know to occur outside of Florida. The typical form extends to New Hampshire and Canada.

Caripeta aretaria *Wlk.* " Florida " (Sloss.).

Extends to Virginia.

Nepytia fumosaria *Strck.* " Florida " (Koebele); Lakeland, May 7 (A. M. N. H.).

Extends to New Hampshire and Illinois.

Alcis luridula *Hulst.* "Florida" (Sloss.); La Grange, Sept. 12 (Ds.).

Occurs in Georgia.

Stenotrachelys approximaria *Hbn.* Silver Springs, Sept. 25, Leesburg, Sept. 26 (Engelhardt).

Larva on *Smilax rotundifolia* and *S. laurifolia.*

Occurs in Georgia and North Carolina.

Tornos scolopacinaria *Gn.* Punta Gorda, Feb. (Sloss.); Fort Myers, May 1–7 (McD.).

Larva on *Coreopsis.*

Extends to Pennsylvania, Wisconsin and Arizona.

Tornos cinctarius *Hulst.* "Florida" (Sloss.); Orlando, Apr. 3 (Pearsall).

Occurs in Georgia.

Exelis pyrolaria *Gn.* Lakeland, Mar. 28 (A. M. N. H.), May 1–7 (McD.), May 5 (Ds.).

Extends to Kentucky and Texas.

Selidosema humarium *Gn.* "East Florida," St. Johns Bluff (Doubleday); Lakeland, May 4, 5, 8 (A. M. N. H., Ds.).

Extends to New York. The records for New Mexico and California were based on an error. The species is also recorded from Mexico but this should be verified.

Selidosema cypressaria, new species.

Expanse, 23–28 mm. Head, body and all wings sordid pale gray with an ochreous tinge. Palpi with scattered dark brown, nearly blackish scales; front with a similarly colored line across the middle, and the space between the antennæ also blackish-brown. Tegulæ usually blackish on their posterior margins. Abdomen sometimes blackish on the posterior edge of the basal segments. Basal line of primaries wanting. Intradiscal line dark brown often obscure, sometimes strongly contrasted, moderately broad, bends outward from costa at one-third from base to middle of cell, then turns rather sharply inward and extends slightly sinuous to inner margin. Extradiscal line concolorous with intradiscal and like it may be obscure or prominent; it begins on costa one-third in from apex, extends to M_2, usually angled inward before reaching this vein, then rounds inward and runs sinuously to middle of inner margin. Both these lines are bordered, the first inwardly the second outwardly, by a broad ochreous shade, more or less pronounced. Median shade rarely present running through the elongated, faintly ringed, dark discal mark. Subterminal line whitish, strongly dentate or scalloped. Terminal line brown, scalloped, often broken and then presenting a series of intervenular points. Secondaries with basal and intradiscal lines absent. Median shade broad, straight, dark brown with diffuse edges; this line is nearly always the most prominent feature on the insect. Extradiscal line usually well marked, sinuous, frequently connecting with discal mark, which otherwise is situated between the two lines, and followed by an ochreous shade. Terminal and subterminal lines as on primaries. Beneath, dull gray washed with dark brown, particularly on inner half of primaries (♂) or near apex (♀). Conspicuous dark brown discal spots which are never ringed and present on all wings.

This species was very abundant in the cypress swamps where frequently a dozen occurred on a single trunk of a tree upon which the larvæ no doubt feed. Though many specimens were taken, few were in really good condition and of the thirty odd examples before me only ten have been selected to serve as types, eight from the Museum collection and two from the collection of Mr. Davis.

The localities at which this species has been collected are as follows: Hastings, May, June 24–30 (A. M. N. H.); Lakeland, May 4, 5 (Ds.); Deep Lake, Apr. 13, Allen River to Deep Lake, Apr. 12, 14 (A. M. N. H., Ds.). I have specimens also from Texas.

It seems strange that so common an insect coming from two quite widely separated states should remain so long undescribed, yet such is apparently the case. None of Walker's numerous descriptions of Florida moths seem to fit the present species, and Mr. L. B. Prout who very kindly looked through the British Museum collection for me says he cannot find it there. There seems no alternative, then, but to describe it. The species resembles most nearly the more modest colored form of Hulst's *Cleora pergracilis,* particularly what I take to be the male of this species, but may be separated from it by its duller color, by the prominent median shade of the secondaries, and by the discal spots which are nearly always solid; in *pergracilis* they are neatly ringed in all the specimens I have seen. *Cypressaria,* also, has no hair pencil in the hind tibiæ, though these are greatly dilated and show very distinct groves.

In both of the Lakeland specimens there is a slight tendency toward melanism. The transverse lines are also heavier and blacker and all the discal spots are very much larger and blacker than in typical specimens.

Cleora defectaria *Gn.* (*Selidosema;* Dyar 3838, syn.). St. Johns Bluff (Doubleday); Leesburg, Sept. 10 (Engelhardt); Glenwood (Barnes); Indian River (A. M. N. H.); Lakeland, Mar. 28, May 1, 4, 5, 6, 7 (A. M. N. H., Ds., McD.); La Belle, Apr. 28 (A. M. N. H., Ds.); Everglade, Apr. 1–7 (McD.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on oak.

Extends to Washington, D. C., and Texas.

Dr. McDunnough who has bred the species from eggs obtained from a female secured in Florida, has handed me the following descriptions of the larval stages.

Stage I.— Head light red-brown; body deep-brown; traces of a white geminate dorsal line, only distinct on the posterior margin of the rear segments in the form of spots; a faint subdorsal line; a spiracular white band with irregular dorsal edge, jutting up into the dark lateral area; traces of pale lines immediately above and beneath this band; tubercles minute, black, with short black seta; spiracles black.

Width of head .3 mm. Length 2 mm.

Stage II.— Head flat. .5 mm. wide, red-brown, marbled with white; body pale brown with greenish tinge, covered with numerous fine, waved longitudinal white lines, about six on each side of the medio-dorsal line; the spiracular area shows traces of a pale band, irregular and not distinctly defined; tubercles small, black, with the exception of tubercle II on second abdominal segment, which is large, raised and black; anal segment reddish; beneath dark black-brown.

Length 4–5 mm.

Stage III.— Head square. 1 mm. wide, red-brown, marbled with white; body smooth, red-brown, shading into greenish laterally; often with green tinge in central portion of abdominal segments; lines much as in preceding stage; posterior portion of second abdominal segment with prominent dorsal and lateral warts, more or less black and arising from a blackish area; dorsal tubercles on other abdominal segments small black points; other tubercles pale, not noticeable; beneath dark.

Length 10 mm.

Stage IV.— Head square, rounded at apex of lobes, red-brown, heavily marbled with creamy. Body olive green or olive brown somewhat suffused with reddish anteriorly and posteriorly; numerous wavy longitudinal pale lines, bordered slightly with brown; tubercles small, black, those of the dorsal rows being larger and more distinct; second abdominal segment with two dorsal warts conical, red-brown, suffused with black at base; a small lateral wart posterior to the spiracle arising from a black area and itself largely black; slight elevation on posterior portion of eighth abdominal segment dorsally, this portion being occupied by tubercle II; spiracles whitish; beneath much as above, striped, pale centrally; intersegmental area rather reddish orange; prolegs shaded with purplish.

Length 15 mm.

Stage V.— Head square, central portion of lobes pale yellow-brown slightly mottled with red-brown; lateral and upper portion of head red-brown, width 2 mm. Body pale brown shading laterally into greenish, striate as in previous stages with fine wavy longitudinal lines; dorsal warts on abdominal segment II compressed from back to front, red-brown, tinged with yellow with tubercle II at apex, black, warts preceded by dark-brown shade patch; lateral warts broad, shaded with blackish, lighter at base; dorsal warts on eighth abdominal segment small, palish, surmounted by tubercle II which is conical and deep brown; other tubercles small, black; spiracles ochreous, tinged with red-brown; ventrally two small black warts on posterior portion of abdominal segment III arising from a reddish base; prolegs marbled with red-brown.

Length (full grown) 38 mm.

Cleora umbrosaria *Hbn.* (*Selidosema*). Lakeland, May 4, 5, 7 (A. M. N. H., Ds., McD.).

Extends to New York.

The records of the occurrence of this species in British Columbia and Alberta were based on errors. All the males taken at Lakeland possess well developed hair pencils.

Cleora pergracilis *Hulst* (*Synelys*). Everglade, Apr. 6, Lakeland, May 6 (A. M. N. H.); Apr. 8–15 (McD.); Allen River to Deep Lake, Apr. 12 (A. M. N. H.); Biscayne Bay (Sloss.). These records refer to the form described by Hulst in which the two principal cross lines are very broad and conspicuous and the intervening space white. The more common form which has been taken at Lakeland, May 5, Fort Myers, Apr. 7, 22, South Bay, Lake Okeechobee, Apr. 30, May, Allen River to Deep Lake, Apr. 12, 14, and Everglade, Apr. 5, 6, 7, 9, 14 (A. M. N. H., Ds.), has the cross lines narrow edged with a broad deep ochreous band and the ground color is grayer. The males are much smaller than the females but are otherwise exactly the same, even to the development of the broad lined variety.

The species is so far known only from Florida.

Cleora indicataria *Wlk.* "East Florida" (Doubleday).

Extends to Maine, Canada, British Columbia and Texas.

Cleora pampinaria *Gn.* St. Johns Bluff (Doubleday); Glenwood, July 8–15 (Barnes); Enterprise, Apr. (Castle and Laurent); Lakeland, May 5, 6, 7, 8 (A. M. N. H., Ds.); Fort Myers, Apr. 22 (Ds.); Miami (Barnes).

Larva on a great variety of plants, among them *Geranium, Pyrus, Salix, Populus, Fraxinus, Acer, Ulmus, Citrus,* guava, cotton, clover, honey locust, hickory, asparagus, cranberry, blackberry and strawberry.

Extends to Canada, British Columbia, Arizona and Mexico.

Cleora vellivolata *Hulst.* "Florida," May 6 (Hulst.).

Extends to New Hampshire, New York and Texas.

Melanolophia canadaria *Gn.* "East Florida," (Doubleday).

Larva on tamarack, hemlock, spruce, pine and *Myrica.*

Extends through the Atlantic States to Canada.

Glena cognataria *Hbn.* (*Selidosema muricolor* Hulst). "Florida" (Sloss.).

This record probably refers to the following species.

Glena umatillaria *Strck.* (*Cosymbia*; *Selidosema insaria* Dyar). "Florida" (Doll); Lakeland, May 16–23 (McD.); Fort Meade (Merrick); Fort Myers, Apr. 26 (A. M. N. H.), May 16–23 (McD.); [De Funiak Springs, Oct. 17].

This is scarcely more than a pale southern race of *Glena cognataria* Hbn.

Glena (?) **texanaria** *Hulst.* "Florida" (Sloss.); Ortega, Nov. 3 (A. M. N. H.).

Occurs in Texas.

Ectropis crepuscularia *D. and S.* "Florida" (Sloss.); [Monticello, Oct. 7].

Larva on *Ligustrum, Lonicera, Rubus, Quercus, Genista, Betula alba, Ulmus, Acer, Pyrus, Negundo aceroides,* white clover, plum, rose and "common locust." In addition, it is recorded in Europe on *Salix, Populus, Sambucus, Spartium, Alnus* and *Aquilegia.*

Extends to Canada and British Columbia.

Epimecis virginiaria *Cram.* Indian River (A. M. N. H.); Biscayne Bay (Sloss.).

Variety **dendraria** *Gn.* " Florida " (Sloss.).

Larva on tulip.

Extends through the Atlantic States to Massachusetts.

Nacophora ypsilon *Forbes.* Charlotte Harbor (Sloss.).

Larva on apple.

Extends to Illinois.

Nacophora phigaliaria *Gn.* " Florida " (Sloss.).

Extends to New Jersey.

Nacophora quernaria *S. and A.* " Florida " (Sloss.).

Larva on *Quercus* and *Cratægus.*

Extends to Canada and Ohio.

Therina fiscellaria *Gn.* " Florida," May (Dyar); Crescent City (Packard); Rockledge, May (Williams).

Larva on *Quercus*; live oak has been specifically recorded.

Extends to Canada and Colorado.

Therina fervidaria *Hbn.* " East Florida " (Doubleday); Indian River (A. M. N. H.); Lakeland, May 5, 6, La Belle, Apr. 27, 28 (A. M. N. H., Ds.).

Larva on spruce, *Abies balsamia, Halesia dipterum* and live oak.

Extends to Maine.

Sericoptera virginaria *Hulst* (*Ripula*). Indian River (Edwards); Everglade, Apr. 9, 10 (A. M. N. H.).

Form **vestalis** *Hulst.* Jupiter, Feb. 21 (Dyar); Charlotte Harbor (Sloss.); Everglade, 5, 6, 9, 11, 15 (A. M. N. H., Ds., McD.); Cudjo Key (Pollard).

There is no doubt whatsoever that *vestalis* is simply an immaculate form of *virginaria.* Indeed the markings on the typical form are so slight that the two might well be included under one name. The form *virginiaria* occurs also in Cuba, according to Dyar, and *vestalis* has been redescribed as *bilineata* from French Guiana by Warren, according to the same authority.

Ennomos subsignarius *Hbn.* Deep Lake, Apr. 13 (Ds.); Allen River to Deep Lake, Apr. 14 (A. M. N. H.).

Larva on *Tilia americana, Ulmus, Hicoria, Acer, Populus, Castanea* and *Pyrus.*

Extends to Canada and Colorado.

Xanthotype crocataria *Fabr.* Jacksonville (Sloss.), Sept. 7 (Sleight); Enterprise (Sloss.); Lakeland, Mar. 28 (Ds.), May 1–7 (McD.); [East Gainesville, Sept. 28; Lake Miceosukee, Monticello, Oct. 8].

Larva on *Polygonum*, red currant, "wild currant," strawberry, gooseberry and mint.

Extends to Canada and Colorado.

Ania limbaria *Haw.* Hastings (Hulst.).

Larva on *Quercus, Acer, Cratægus, Salix,* pear, currant, gooseberry, strawberry and rose.

Gonodontis hypochraria var. **homuraria** *Grt.* "Florida" (Sloss.).

The typical form of this species almost certainly occurs in Florida also.

Larva on *Diospyros virginiana,* sassafras and apple.

Extends through the Atlantic States to Canada.

Gonodontis obfirmaria *Hbn.* "Florida" (Sloss., A. M. N. H.); "East Florida" (Doubleday).

Larva on *Vaccinium, Cassandra* and bearberry.

Extends through the Atlantic States to Canada.

Gonodontis antidiscaria *Wlk.* "East Florida" (Doubleday); "Central Florida" (Neumoegen).

Known only from Florida.

Euchlæna amœnaria *Gn.* [Gainesville (Coll. Agric. Exp. Sta.).

Extends through the Atlantic States.]

Euchlæna astylusaria *Wlk.* (*vinulentaria* G. and R.). "East Florida," St. Johns Bluff (Doubleday); Lakeland, May 8 (A. M. N. H.); Fort Myers, May 1–7 (McD.), Apr. 1, 2, 3, 24 (A. M. N. H.); La Belle, Apr. 27 (Ds.).

Variety **tiviaria** *Wlk.* St. Johns Bluff (Doubleday).

Extends to Canada.

Euchlæna pectinaria *D. and S.* "East Florida" (Doubleday).

Larva on *Prunus, Quercus* and *Populus.*

Extends to Massachusetts, Canada and Illinois.

Metanema quercivoraria *Gn.* "East Florida" (Doubleday).

Larva on *Quercus, Populus, Uvularia perfoliata, Ulmus, Salix* and bellwort.

Extends to Canada.

Azelina zalissaria *Wlk.* (*Stenaspilates*). "East Florida" (Doubleday); Charlotte Harbor (Sloss.).

Extends along the Atlantic coast to New Jersey.

Azelina rectissima *Dyar* (*Stenaspilates*). Jacksonville, Sept. 28 (Ds.); Charlotte Harbor, Biscayne Bay (Sloss.).

Extends to Texas and Mexico.

Azelina atrocolorata *Hulst.* "Florida" (Hulst).

This species was described from several examples taken in various eastern States. Of four of the types that I have located and examined, three are *Pero honestarius* Wlk. The fourth from Florida is a distinct species on which (Proc. U. S. Nat. Mus., XXXVIII, p. 365) I have held the above name.

Pero honestarius *Wlk.* (*Azelina*). "Florida" (Sloss.).

Larva on wild cherry and maple.

Extends to Canada, Alberta, Colorado and Texas.

Patalene olyzonaria *Wlk.* (*Syssaura*). La Grange, Sept. 10, 11 (Ds.); Indian River (Neumoegen); Charlotte Harbor (Sloss.).

Occurs in Georgia and the Antilles.

Infensata, siculata and *syzygiaria,* also reported from Florida, have been found to refer to this species.

Caberodes juncturaria *Gn.* "Florida" (Neumoegen).

Extends to South Carolina and Texas.

Caberodes confusaria *Hbn.* "East Florida" (Doubleday); Lake Lucy, Jan. 8 (A. M. N. H.); Enterprise (Castle and Laurent); Deep Lake, Apr. 13, Everglade, Apr. 6 (A. M. N. H.).

Larva on *Taraxacum* and *Trifolium.*

Extends to Canada and Colorado.

Oxydia vesulia *Cram.* Charlotte Harbor, Punta Gorda (Sloss.); Boca Grande, Apr. (Ds.); Fort Myers, Mar. 21 (A. M. N. H.); Marco, Apr. 11, larva (Ds.); Everglade, Apr. 6, 8, 9 (A. M. N. H.); Miami (Sloss.).

Larva on oak.

Extends to Texas and through Mexico and the Antilles to Brazil.

Sabulodes transversata *Dru.* St. Johns Bluff (Doubleday); Crescent City (Pack.); Charlotte Harbor (Sloss.); [De Funiak Springs, Oct. 18].

Larva on *Acer rubrum, Clethra alnifolia, Myrica, Geranium, Polygonum,* live oak, currant and apple.

Extends to Canada.

Sabulodes politia *Cram.* Daytona, Sept. 10 (Engelhardt); Indian River (Grote, Neumoegen); Charlotte Harbor, Punta Gorda, Feb. (Sloss.); Fort Myers, Mar. 21, 30, Apr. 22, 23, May 3 (A. M. N. H., Ds.), May 1–7 (McD.); South Bay, Lake Okeechobee, Apr. 30 (Ds.); Lake Worth (Dyar); Marco, Apr. 20 (Ds.); Everglade, Apr. 5, 6, 9 (A. M. N. H., Ds.), May 16–23 (McD.); Chokoloskee (A. M. N. H., Barnes); Biscayne Bay (Sloss.).

Extends through Mexico and the Antilles to South America.

Abbottana clemataria *S. and A.* "Florida" (Sloss.); St. Johns Bluff (Doubleday).

Larva on *Quercus, Ulmus, Sassafras, Clematis* and *Hicoria.* It is also figured by Abbot on *Pyrrhopappus carolinianus.*

Extends through the Atlantic States to Canada.

Palyas auriferaria *Hulst.* Indian River (A. M. N. H., Hulst); Lake Worth (Dyar); Charlotte Harbor (Sloss.); Fort Myers, Apr. 22 (A. M.

N. H.), May 1–7 (McD.); Marco, Apr. 19 (A. M. N. H.); Deep Lake, Apr. 13 (Ds.); Everglade, Apr. 1–15 (McD.), Apr. 7 (Ds.); Biscayne Bay (Sloss.).

Known only from Florida.

Phrygionis argentiostriata *Strck.* Indian River (A. M. N. H., Grote); Lake Worth (Dyar); Charlotte Harbor, Punta Gorda, Feb. (Sloss.); South Bay, Lake Okeechobee, Apr. 30, Deep Lake, Apr. 13, 14 (A. M. N. H.); Everglade, Apr. 1–7 (McD.), Apr. (Ds.); Chokoloskee (Barnes), Apr. 8 (Ds.).

Larva on *Ardisia pickeringia.*

This species was not rare at Deep Lake where it flew in the shaded swamps; its flight resembled that of the Satyridæ, that is, in momentarily holding the wings together over the back. It seems also to have a propensity to fly around porches in the evening, seeking the protected corners to rest.

Sphæcelodes vulneraria *Hbn.* Indian River (A. M. N. H., Holland).

Extends to North Carolina (though a single instance of its capture at New York is on record) and through Mexico and the Antilles to Argentina.

Melanchroia regnatrix *Grt.* This is questionably recorded from Florida by Hulst.

It occurs in Cuba.

Melanchroia cephise *Cram.* Florida (Hulst).

Extends to southern California and through Mexico and the Antilles to South America.

Melanchroia geometroides *Wlk.* "Florida" (A. M. N. H.); Key West (Morrison).

Larva on *Cicca disticha* in Cuba.

Extends to Texas and through Mexico and the Antilles.

EPIPLEMIDÆ.

Philagraula slossoniæ *Hulst.* "South Florida" (Sloss.); Everglade, Apr. 8–15 (McD.).

Appears to be closely related to *Erosia mamillata* Feld. (Reise Nov., Pl. 133, f. 18). (McD.).

LACOSOMIDÆ.

Cicinnus melsheimeri *Harr.* Lakeland, larval case (Ds.); Charlotte Harbor, Lake Worth (Sloss.); Fort Myers, Mar. 30 (A. M. N. H.); Biscayne Bay (Sloss.); [St. Augustine (Johnson)].

Larva on oak and winterberry.

Extends through the Atlantic States to New York.

PSYCHIDÆ.

Oiketicus abbotii *Grt.* Charlotte Harbor (Sloss.); Punta Gorda, larvæ (Sloss.); Fort Myers (McD.), Mar. 30 (A. M. N. H.); Everglade (McD.). Cases have also been taken at Tallahassee (A. M. N. H.); Jacksonville, Newberry, Lakeland (Ds.); Fort Myers (A. M. N. H., Ds.); Marco, Everglade (A. M. N. H.); Miami, Key West (Ds.); [near De Funiak Springs (G. C. Fisher)].

Larva on *Citrus* and Japanese plum. Cases common on guava (McD.).

Known also from Texas.

Thyridopteryx ephemeræformis *Haw.* Biscayne Bay (Sloss.).

Larva on *Pinus, Cupressus, Salix, Populus, Quercus, Acer* and arborvitæ.

Extends through the Atlantic States to New York. It is probable that the Florida record refers to the following species.

Thyridopteryx pallidovenata, new species.

♂.—Expanse, 34.5 mm. Head and body above and beneath dark smoky brown with paler brown silken reflections; antennæ brown, the tips yellowish. Wings hyaline, the veins yellowish-white. Primaries with costa narrow and basal portion of the inner margin broadly marked with dark brown. Secondaries with the inner area almost completely marked with brown to Cu_2; costal margin also brown. Beneath as above but the brown scales less dense.

One male, Fort Myers, Apr. 23, taken at light. Closely allied to *T. ephemeræformis* Haw. but one-third larger than average sized specimens of that species and one-fourth larger than the largest examples in the long series before me. The wings are also a whiter hyaline and the veins of a paler tint than is probably ever attained (through abrasion) in *ephemeræformis*.

Type in the American Museum of Natural History.

Cases, apparently of this species, were taken at Lakeland and Everglade (A. M. N. H.), and at Key West (Ds.).

Platœceticus gloveri *Pack.* Jacksonville, Enterprise, Charlotte Harbor, Punta Gorda, Feb. (Sloss.); Fort Myers, Apr. 22 (Ds.); Allen River to Deep Lake, Apr. 14 (A. M. N. H., Ds.); Everglade, Apr. 12, 14 (A. M. N. H.). Cases presumably of this species have also been taken at Lakeland (A. M. N. H., Ds.); Punta Gorda, on pine (Ds.); Fort Myers, Everglade (A. M. N. H.); Key West (Ds.).

Known only from Florida.

Prochalia pygmæa *B. and McD.* [Everglade, Apr. 1–7 (McD.).

Known only from Florida.]

Manatha nigrita *B. and McD.* Fort Myers, Apr. 24–30, Everglade, Apr. 8–15 (McD.).

Larva "evidently feeds on coarse grasses."

Known only from Florida.

COCHLIDIIDÆ.

Sibine stimulea *Clem.* Lake Worth (Dyar); [near de Funiak Springs (G. C. Fisher)].

Larva on a wide range of plants, among them, basswood, cherry, chestnut, oak, corn leaves, sumac, rose, *Prunus, Rubus, Pyrus, Cratœgus, Amelanchier, Cornus, Virburnum, Vaccinium, Myrica, Canna indica, Sebastiana lucida* and *Verbesina virginica.* For exhaustive list of food plants see Ent. Am., IV, p. 75.

Extends through the Atlantic States to New York and Massachusetts.

Euclea nanina *Dyar.* "Central Florida" (A. M. N. H.); Charlotte Harbor (Sloss.).

Known only from Florida.

Euclea delphinii *Bd.* Tallahassee (A. M. N. H.); Lake Worth (Dyar), larvæ in Jan. (Dyar); Everglade, Apr. 9 (A. M. N. H.).

Larva on *Rhizophora mangle, Coccoloba uvifera, C. floridana, Andromeda, Nyssa, Salix, Pyrus,* cocoanut palm, blackberry, wax myrtle, oak, chestnut, beech and wild cherry.

Extends through the Atlantic States to Canada (Quebec).

Monoleuca subdentosa *Dyar.* "Florida" (Dyar); Fort Myers (McD.).

Known only from Florida.

Monoleuca sulfurea *G. and R.* "Florida" (Dyar).

Known only from Florida.

Monoleuca obliqua *Hy. Edw.* Indian River (Edw.).

Known only from Florida.

Isochætes beutenmülleri *Hy. Edw.* Enterprise, Mar. 31 (A. M. N. H.).

Larva on swamp oak.

Extends to Staten Island.

Alarodia slossoniæ *Pack.* Charlotte Harbor (Sloss.); Lake Worth (Dyar); Everglade (McD.), Apr. 6 (A. M. N. H.); Miami, Feb., Biscayne Bay (Sloss.).

Larva on *Rhizophora mangle, Myrsine floridana, Ardisia pickeringia, Myrica cerifera, Hypelate paniculata,* and *Chrysobalanus icacoa.*

This species has also been recorded, doubtfully, from Texas.

Cochlidion y-inversa *Pack.* Indian River (Edwards).

Variety **parallela** *Hy. Edw.* Indian River (A. M. N. H.).

Larva on hickory and blue beech.

Extends to Canada (Quebec).

Slossonella tenebrosa *Dyar.* Jacksonville (Sloss.).

Known only from Florida.

Prolimacodes badia argentimacula *B. and McD.* (*scapha*). Fort Myers, Apr. 2 (Ds.), Apr. 23 (A. M. N. H., Apr. 16–23, May 1–7 (McD.).

Larva on various shrubs and trees, among them, *Pyrus, Citrus, Ulmus,* oak, chestnut, wild cherry, hickory, sweet gum, bayberry, linden, witch hazel and hop hornbeam.

Extends to Massachusetts.

MEGALOPYGIDÆ.

Carama cretata *Grt.* Biscayne Bay (Sloss.).

Larva on *Cercis canadensis.*

Occurs in the Atlantic States.

Megalopyge opercularis *S. and A.* Fort Myers, Apr. 22 (Ds.); Charlotte Harbor, Lake Worth, Biscayne Bay (Sloss.).

Larva on *Citrus* and *Pyrus.*

Occurs in the South Atlantic States.

Lagoa pyxidifera *S. and A.* Charlotte Harbor, Punta Gorda, Feb. (Sloss.); Fort Myers (McD.); [Gainesville, Aug. 28 (Coll. Agric. Exp. Sta.)].

Larva on *Viccinium* and *Quercus.*

Occurs in the South Atlantic States.

PYROMORPHIDÆ.

Acoloithus falsarius *Clem.* La Grange, Sept. 11 (Ds.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Ampelopsis* and *Vitis.*

Extends through the Atlantic States to New York.

Acoloithus rectarius *Dyar.* Lake Worth, Biscayne Bay (Sloss.).

Hitherto known only from Arizona.

Pyromorpha centralis *Wlk.* "Florida" (Barnes).

A Mexican species of doubtful occurrence in Florida, according to Dyar.

Harrisina americana *G.–M.* Enterprise, Apr. (Castle and Laurent); Eustis (Dyar); Biscayne Bay (Sloss.).

Larva on *Vitis* and *Ampelopsis.*

Extends through the Atlantic States to New York.

Harrisina australis *Stretch.* Enterprise (Dyar); Indian River (A. M. N. H.); Lakeland, May 8 (Ds.); Fort Myers (McD.), Apr. 2 (A. M. N. H., Ds.); Miami, Feb. (Sloss.).

Extends to Missouri.

The specimens from Lakeland and Fort Myers are all smaller and less metallic in color than the typical form and thus approach the preceding species from which it differs not only in the extension of the yellow collar to the coxæ but in venation.

Concerning the larva, Dr. McDunnough writes: — "At Fort Myers, larvæ were common on a climbing vine which I could not identify: although wild grape grew in the immediate vicinity no larvæ were found on it. The larvæ differ from those of *texana* Stretch as described by Dyar (Proc. Ent. Soc. Wash., V, p. 326) in the following important particulars: there is no intersegmental black band dorsally, the only transverse band being the purple-brown one containing the warts; this band extends laterally as far as the third row of warts, leaving the fourth isolated in a small purple patch; the lateral purple-brown band is entirely lacking; the general color is yellowish, paler dorsally."

THYRIDÆ.

Thyris lugubris *Bd.* "Florida." [St. Augustine (Johnson).]

Extends through the Atlantic States to New Jersey.

Dysodia speculifera *Sepp.* "Florida" (Hampson).

Extends into South America.

Dysodia flagrata *Wlk.* (*floridanus* Hulst). "Florida" (Doll).

Occurs in South America.

Hexeris enhydris *Grt.* Lake Worth (Sloss.); Marco, Apr. 17 (A. M. N. H.); Chokoloskee (Barnes); Fort Capron (Hubbard and Schwarz); Biscayne Bay (Sloss.); Flamingo (Ottolengui).

Extends to California.

Meskea dyspteraria *Grt.* Biscayne Bay (Sloss.).

Known only from Florida.

COSSIDÆ.

Givira basalis *Wlk.* Tallahassee (A. M. N. H., Koebele); Jacksonville (Sloss.); St. Johns Bluff (Doubleday); Indian River (A. M. N. H., Wittfeld); Biscayne Bay (Sloss.).

Occurs in Mexico.

Givira francesca *Dyar.* Fort Meade (Merrick).

Known only from Florida.

Givira anna *Dyar.* Miami, Biscayne Bay (Sloss.).

Known only from Florida.

Cossula magnifica *Strck.* Tallahassee (Koebele); Jacksonville (Barnes).

Larva on *Quercus virens.*

Known only from Florida.

Prionoxystus robiniæ *Peck.* Fort Myers, Apr. 1 (Ds.).

Larva on *Robinia pseudacacia, Populus* spp., *Salix,* oak and chestnut.

Occurs throughout the United States.

ÆGERIIDÆ.

Melittia satyriniformis *Hbn.* [St. Augustine (Johnson).

Larva bores in the stems of *Cucurbitaceæ.*

Extends over practically all of the United States, Canada and to Argentina.]

Alcothoe caudata *Harr.* "Florida," Apr., May (Beutenmüller).

Larva bores in the roots of *Clematis virginiana* and *C. vitalba* and in the stems of *Ribes floridum.*

Extends to Canada, New England, Michigan and Illinois.

Synanthedon exitiosa *Say* (*Sesia*). "Florida" (Beutenmüller).

Variety **fitchii** *Hy. Edw.*, Tallahassee (Koebele).

Larva in peach, plum, almond, nectarine, apricot, wild and cultivated cherry, willow, beach plum and *Amelanchier canadensis*.

Extends to Maine, Canada, Texas and the Rocky Mountains.

Synanthedon pictipes *G. and R.* (*Sesia*). "Florida" (Beutenmüller).

Larva under bark of plum, wild and cultivated cherry, beach plum, peach, chestnut and *Amelanchier canadensis*.

Extends to Canada, Texas and the Pacific.

Synanthedon pyri *Harr.* (*Sesia*). "Florida" (Beutenmüller).

Larva under and in bark of apple, pear and mountain ash.

Extends through Atlantic States to Canada. Occurs also in Texas.

Synanthedon texana *Hy. Edw.* (*Sesia*). Indian River (Wittfeld); South Bay, Lake Okeechobee, May 2 (Ds.); Biscayne Bay (Sloss.).

Occurs in Texas.

Synanthedon seminole *Beut.* (*Sesia*). Jacksonville (Sloss.); Lake Worth (Sloss., Dyar).

Known only from Florida.

Synanthedon marica *Beut.* (*Sesia*). Jacksonville, Punta Gorda (Sloss.).

Known only from Florida.

Synanthedon floridensis *Grt.* (*Sesia*). Jacksonville (Sloss.); Enterprise, Mar. 29 (Hubb. and Schwarz), May 29 (A. M. N. H.); Biscayne Bay (Sloss.).

Known only from Florida.

Synanthedon geliformis *Wlk.* (*Sesia*). Jacksonville (Sloss.); Archer (Koebele); Tampa, Charlotte Harbor (Sloss.).

Occurs in the Antilles and Mexico.

Synanthedon sapygæformis *Wlk.* (*Sesia*). "East Florida" (A. M. N. H.).

Known only from Florida.

Synanthedon ruficornis *Hy. Edw.* (*Sesia*). "Florida" (A. M. N. H.); La Grange, Sept. 11 (Ds.).

Known also from Georgia and Alabama.

Sannina uroceriformis *Wlk.* (*Sanninoidea*). "Florida" (Beutenmüller).

Larva in persimmon.

Extends through the Atlantic States to Virginia.

Memythrus scepsiformis *Hy. Edw.* Biscayne Bay (Sloss.).

Extends to Maryland, Kansas and Texas.

Memythrus palmii *Hy. Edw.* Enterprise (Palm).

Known only from Florida.

Memythrus asilipennis *Bd.* Jacksonville (Sloss.).

Larva bores in oak. Ash and alder recorded as food plants of this species is an error (Engelhardt).

Extends to New Hampshire, Minnesota and Texas.

Memythrus seminole *Neum.* "Florida" (Neumoegen); Ortega, Sept. 6 (Sleight).

Known only from Florida.

The Ortega example differs considerably from the description of the type and may represent a new species. The central portion of the antennæ are darkened by brown scales, the hind tibiæ are also brown above toward their apices, while the border of the secondaries extends inward along the cubital and anal veins to the center of the wing. All these characters are at variance with the description of the type. In other details the specimen fits the description so closely that I am inclined to regard it as a variant.

PYRALIDÆ.

Pyraustinæ.

Glaphria glaphyralis *Gn.* "Florida" (A. M. N. H.); Lakeland, Marco (McD.).

Extends through the Atlantic States to New Jersey.

Glaphria sesquistrialis *Hbn.* Fort Myers, Apr. 22 (A. M. N. H.); Lakeland (McD.); [Monticello, Oct. 5].

Extends to New Jersey, Missouri, Texas and Honduras.

Glaphria fulminalis *Led.* Fort Myers, Everglade (McD.).

The Everglade specimens have the ground color of primaries a deep brown, whereas the Fort Myers specimen has a pale yellow ground suffused with purple-brown in the median area. (McD.).

Extends through the Atlantic States to New Jersey.

Glaphria basiflavalis *B. and McD.* Everglade (McD.); Chokoloskee (Barnes).

Occurs in Texas.

Sufetula diminutellus *Wlk.* Everglade (McD.), Apr. 6 (A. M. N. H.).

Occurs in St. Vincent and Honduras.

Hymenia perspectalis *Hbn.* Indian River (A. M. N. H.); Charlotte Harbor (Sloss.); Fort Myers, Apr. 22 (Ds.), Nov. 5 (A. M. N. H.); Everglade (McD.), Apr. 6, 8 (A. M. N. H.); Biscayne Bay (Sloss.); [East Gainesville, Sept. 29; Monticello, Oct. 5; Star Lake, Pensacola, Oct. 13;

Big Bayou, Pensacola, Oct. 14; De Funiak Springs, Oct. 17, 18; Lake Stanley, De Funiak Springs, Oct. 18].

Larva on *Lilium canadense.*

Extends through the Atlantic States to New Jersey and through Mexico and the Antilles to South America. Occurs also in southern and central Africa and in the Australian region.

Hymenia fascialis *Cram.* Jacksonville, Nov. 7, 15 (A. M. N. H.); La Grange, Sept. 9 (Sleight); Lakeland, Nov. 9 (Ds.); Charlotte Harbor (Sloss.); Everglade (McD.); Biscayne Bay (Sloss.); [Payne Prairie, Gainesville, Oct. 2].

Larva on beets.

It is distributed over the southeastern United States, South America, southern Europe, southern and central Africa and the Australian region.

Crocidolomia palindialis *Gn.* (*Evergestis dyaralis* Fern.). Lake Worth (Dyar).

Larva on *Drypetes crocea.*

Extends through the Antilles and Mexico to South America.

Desmia funeralis *Hbn.* Jacksonville (Sloss.); Indian River (A. M. N. H.); Charlotte Harbor (Sloss.); La Belle, Apr. 27 (A. M. N. H.); Fort Myers, Everglade (McD.); Ocean Beach, Sept. 23 (Sleight); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on wild grape (McD.).

Extends through the Atlantic States to Canada.

Desmia tages *Cram.* Lake Worth (Dyar); Chokoloskee (Barnes).

Larva on *Psychotria undata.*

Extends through Mexico and the Antilles to Brazil.

Desmia geminalis *Snell.* Everglade, Apr. 11 (A. M. N. H.).

Known also from Colombia and Peru.

Synclera traducalis *Zell.* "Florida" (Dyar); Indian River (A. M. N. H.).

Extends through Mexico and the Antilles to South America. Occurs also in southern and central Africa and in southern Asia.

Ercta ornatalis *Dup.* Fort Myers, Apr. 1, 23 (Ds.); Marco, Apr. 17 (Ds.), Apr. 20 (A. M. N. H.); Everglade, common (McD.), Apr. 10 (A. M. N. H.).

Extends through the Antilles to South America. Occurs also in southern Europe, southern and central Africa and in the Oriental and Australian regions.

Marasmia cochrusalis *Wlk.* "Florida" (Dyar); Fort Myers (McD.).

Extends through the Antilles to South America.

Marasmia trapezalis *Gn.* Lake Worth (Dyar); Fort Myers, Apr. 24 (A. M. N. H.); Everglade (McD.).

Extends to Texas and through the Antilles to South America. Occurs also in southern and central Africa, and in the Oriental and Australian regions.

Marasmia floridalis *Fern.* Lake Worth (Dyar); Palm Beach, Key West (Fernald).

Larva on *Vincetoxicum palustre.*

Known only from Florida.

Anania florella *Cram.* Fort Myers, Nov. 12, South Bay, Lake Okeechobee, Apr. 29 (A. M. N. H.); Biscayne Bay (Sloss.).

Extends through the Antilles to South America.

Samea ecclesialis *Gn.* Lakeland (McD.), May 4, 8 (A. M. N. H.); Charlotte Harbor (Sloss.); Fort Myers (McD.); La Belle, Apr. 27 (Ds.); Everglade, Apr. 6, 7 (Ds.), Apr. 9 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville, Sept. 27; East Gainesville, Sept. 29; Lake Miceosukee, Monticello, Oct. 6, 8; Monticello, Oct. 7; Crestview, Oct. 15, 16; De Funiak Springs, Oct. 17; Lake Stanley, De Funiak Springs, Oct. 18].

Extends through Mexico and the Antilles to South America.

Samea multiplicalis *Gn.* Jacksonville, Nov. 5 (A. M. N. H.); Fort Myers (McD.), Apr. 23 (A. M. N. H.); La Belle, Apr. 26, 27 (A. M. N. H., Ds.); Everglade (McD.), Apr. 1–7 (Ds.), Apr. 6, 7, 11, 14 (A. M. N. H.).

Extends through the Antilles to South America.

Diastictis argyralis *Hbn.* Lakeland, May 7, 8 (A. M. N. H.); Biscayne Bay (Sloss.); [Devils Mill Hopper, Gainesville, Sept. 27].

Extends through the Atlantic States to New Jersey.

Pilocrocis ramentalis *Led.* Lake Worth (Sloss.).

Extends to New York. Occurs also in Venezuela and Brazil and probably in the Antilles.

Pilocrocis tripunctata *Fabr.* Indian River, South Bay, Lake Okeechobee, Apr. 30, Everglade, Apr. 9 (A. M. N. H.); Miami, Sept. 3 (Sleight); [Monticello, Oct. 5; Crestview, Oct. 15].

Extends to Texas and the Antilles. Reported also from Colombia.

Pilocrocis plumbicostalis *Grt.* West Park (Sloss.); Everglade (McD.); Chokoloskee (Barnes); Biscayne Bay (Sloss.).

Occurs in Alabama.

Pilocrocis inguinalis *Gn.* [Monticello, Oct. 4.

Extends to Alabama and South America.]

Pilocrocis tristigmalis *Hamps.* Miami (Schaus).

Known only from Florida.

Conchylodes diphteralis *Geyer.* Jacksonville (Sloss.).

Extends to Texas and the Antilles.

Conchylodes platinalis *Gn.* Lakeland, May 7, 8 (A. M. N. H., Ds.); [Gainesville (Coll. Agric. Exp. Sta.)].

Distributed through the South Atlantic States and thence through Mexico and the Antilles to South America.

Dichogama redtenbacheri *Led.* Lake Worth (Dyar); Chokoloskee (Barnes).

Larva on *Capparis cynophallophora.*

Occurs in the Antilles and in Mexico, Central and South America.

Dichogama amabilis *Moesch.* Lake Worth (Dyar).

Larva on *Capparis jamaicensis.*

Occurs also in the Antilles.

Dichogama bergii *Moesch.* Lake Worth (Dyar).

Larva on *Capparis cynophallophora.*

Occurs in the Antilles.

Nacoleia hampsoni *B. and McD.* Marco (McD.); Everglade, May (Ds.); Chokoloskee (Barnes).

Known only from Florida.

Hedylepta indicata *Fabr.* Fort Myers, Apr. 25 (Ds.); Marco (McD.), Apr. 19 (Ds.); Everglade (McD.); Biscayne Bay (Sloss.).

Extends through the Antilles to South America. Occurs also in southern and central Africa and in the Oriental region.

Blepharomastix ebulealis *Gn.* Fort Myers (McD.).

Occurs in the Antilles and in Central and South America.

Blepharomastix ranalis *Gn.* Lakeland, May 6 (A. M. N. H.).

Extends to New York and through Mexico and the Antilles to South America.

Blepharomastix magnalis *Gn.* Charlotte Harbor (Sloss.); Fort Myers, common (McD.), Apr. 22, 26 (A. M. N. H.); Allen River to Deep Lake, Apr. 12 (A. M. N. H.); Everglade, common (McD.); Biscayne Bay (Sloss.).

Extends to Texas and into the Antilles.

Blepharomastix stenialis *Gn.* Indian River (A. M. N. H.); Enterprise (Castle and Laurent); Fort Myers, Apr. 23, Everglade, Apr. 7 (A. M. N. H.); Biscayne Bay (Sloss.).

Extends to Quebec and through Mexico and the Antilles to South America.

Asciodes gordialis *Gn.* Indian River (Hulst); Lake Worth (Sloss., Dyar); Everglade (McD.); Biscayne Bay (Sloss.).

Larva on *Pisonia aculeata* and cultivated *Bougainvillea.*

Extends through Mexico and the Antilles to South America.

Asciodes anormalis *Gn.* Lake Worth (Dyar); Charlotte Harbor (Sloss.); Chokoloskee (Barnes).

Larva on *Ipomœa.*

Extends through the Antilles to South America.

Pantographa limata *G. and R.* "Florida" (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.)].

Larva on *Tilia americana* and *Quercus.*

Extends to Maine, Minnesota and through Mexico to South America.

Sylepta penumbralis *Grt.* Fort Myers, Apr. 23 (A. M. N. H.).

Extends to Ohio.

Sylepta fluctuosalis *Led.* Lake Worth (Dyar).

Larva on *Bœhmeria cylindrica.*

The specimen on which this record is based was determined for Dyar by Fernald with a query.

Occurs in South America.

Sylepta obscuralis *Led.* "Florida" (Dyar).

Known only from Florida.

Sylepta elevata *Fabr.* Lake Worth, Biscayne Bay (Sloss.).

Extends through the Antilles to South America.

Sylepta masculinalis *B. and McD.* Marco, Apr. 16, 22 (McD.); Chokoloskee (Barnes).

Known only from Florida.

Lygropia chromalis *Gn.* Everglade (McD.), Apr. 11 (A. M. N. H.); Miami, Sept. 23 (Ds.).

Occurs in Brazil.

Agathodes monstralis *Gn.* Indian River (Hulst); Lake Worth (Dyar).

Larva on *Erythrina herbacea.*

Extends through Mexico and the Antilles to South America.

Paradosis flegia *Cram.* Lake Worth (Dyar); Fort Myers (McD.); Biscayne Bay (Sloss.); Key West, common (Dyar).

Larva on *Thevetia neriifolia.*

Extends through Mexico and the Antilles to South America.

Diaphania olealis *Feld.* Fort Myers (McD.); South Bay, Lake Okeechobee, Apr. 30, Everglade, Apr. 9 (A. M. N. H.).

Occurs in Central and South America and in Mexico.

Diaphania nitidalis *Stoll.* Indian River (A. M. N. H.); Charlotte Harbor (Sloss.); Fort Myers (McD.); [De Funiak Springs, Oct. 18].

Larva in stems of cucurbs.

Extends to New Jersey and through Mexico and the Antilles to South America.

Diaphania infimalis *Gn.* Lake Worth (Dyar); Fort Myers (McD.), Apr. 26 (A. M. N. H.); South Bay, Lake Okeechobee, Apr. 29, 30 (A. M. N. H., Ds.); Marco, Everglade (McD.).

Larva on *Melothria.*

Known only from Florida.

Diaphania niveocilia *Hamps.* "Florida" (Sloss.).

Occurs in Barbados and South America.

Diaphania hyalinata *Linn.* Pablo Beach, Nov. 4 (A. M. N. H.); Sanford, Jan. 27 (Sloss.); Indian River, Lakeland, Nov. 8, Fort Myers, Apr. 23, Nov. 12, 15 (A. M. N. H.); Charlotte Harbor (Sloss.); South Bay, Lake Okeechobee, Apr. 29 (Ds.); Everglade (McD.), Apr. 8, 11 (A. M. N. H., Ds.); [Payne Prairie, Gainesville, Oct. 2].

Larva in stems of cucurbs.

Extends to Quebec and through Mexico and the Antilles to South America.

Diaphania quadristigmalis *Gn.* Enterprise (Castle and Laurent); Lake Worth (Dyar, Sloss.); Marco, Apr. 20 (Ds.); Everglade, (McD.), Apr. 6, 9 (A. M. N. H., Ds.).

Larva on *Forestiera* and *Ligustrum.*

Extends to Quebec and through Mexico and the Antilles to South America.

Diaphania sibillalis *Wlk.* Indian River (A. M. N. H.); Lake Worth (Dyar); Fort Myers (McD.); Chokoloskee (Barnes).

Larva on *Morus rubra.*

Extends to Texas and through Mexico and the Antilles to South America.

Hellula undalis *Fabr.* Lake Worth (Dyar); Charlotte Harbor (Sloss.); Fort Myers (McD.); Everglade (McD.), Apr. 6, 10 (A. M. N. H.); Biscayne Bay (Sloss.).

Distributed over the Southern States. Occurs also in southern Europe, southern and central Africa and in the Oriental region.

Terastia meticulosalis *Gn.* Indian River (Hulst); Lake Worth (Dyar); Charlotte Harbor (Sloss.); Fort Myers (McD.), Apr. 22 (A. M. N. H.); Marco, Apr. 20 (A. M. N. H.); Everglade (McD.), Apr. 11 (Ds.).

Larva bores in young stems of *Erythrina herbacea* and, according to McDunnough, in the large seed pods of the "Cherokee bean." (Possibly these two names refer to one species; both belong to the Leguminosæ).

Occurs in Central America, Mexico, the Antilles, Ceylon, Java and the Philippine Islands.

Evergestis rimosalis *Gn.* Marco, Apr. 6 (A. M. N. H.).

[Extends to West Virginia.] Occurs also in South America.

Crocidophora pustuliferalis *Led.* "Florida" (Dyar).

Known only from Florida.

Stenophyes huronalis *Gn.* Lakeland, May 5, 7 (A. M. N. H.); Fort Myers (McD.), Apr. 23, 24 (Ds.); La Belle, Apr. 27 (Ds.); [Devils Mill Hopper, Gainesville, Sept. 27; Gainesville, Sept. 27, Oct. 2; East Gainesville, Sept. 28; Monticello, Oct. 5, 7, 8; Lake Miceosukee, Monticello, Oct. 6, 8].

Extends through the Antilles to South America.

Nomophila noctuella *D. and S.* Lake Worth (Dyar); Biscayne Bay (Sloss.); [Crestview, Oct. 16; De Funiak Springs, Oct. 17].

Extends to Quebec and through Mexico and the Antilles to South America. Occurs also in Europe, Asia and Africa. Hampson says it is "universally distributed."

Pachyzancla periusalis *Wlk.* Fort Myers, Apr. 25 (Ds.); Everglade (McD.).

Larva on tomato (McD.).

Occurs in Brazil.

Pachyzancla bipunctalis *Fabr.* Newberry, Nov. 18 (Ds.); Indian River (A. M. N. H.); Fort Myers, Apr. 22 (Ds.), Nov. 1 (A. M. N. H.); Everglade (McD.), Apr. 7, 8, 9 (A. M. N. H., Ds.); Biscayne Bay (Sloss.); [Agric. Exp. Sta. grounds, Gainesville, Sept. 26; Gainesville, Sept. 27, Oct. 2; Lake Stanley, De Funiak Springs, Oct. 18].

Extends to New Jersey and through the Antilles to South America. Occurs also in central and southern Africa and in the Oriental region.

Pachyzancla phæopteralis *Gn.* Fort Myers (McD.), Nov. 12, 15 (A. M. N. H.); Marco, Everglade (McD.).

Occurs throughout the "Tropical Zone" according to Hampson.

Loxostege dasconalis *Wlk.* Jacksonville (Sloss.).

Extends to New York, Illinois and Colorado.

Loxostege helvialis *Wlk.* Lakeland (McD.), May 4, 5, 7 (A. M. N. H., Ds.); Fort Myers, Apr. 22 (A. M. N. H.).

Extends through the Atlantic States to New Jersey. Occurs also in Mexico and Central America.

Loxostege mancalis *Led.* "Florida" (Dyar).

Extends to Virginia and Missouri.

Loxostege similalis *Gn.* Lakeland (McD.), May 5 (A. M. N. H.); Fort Myers, Everglade (McD.)

The larva of the variety *rantalis* Gn. is said to feed on *Ipomœa batatas, Medicago sativa, Amaranthus* and *Portulàca oleracea.*

Extends to New Jersey, Kansas, and through the Antilles to South America.

Loxostege albiceralis *Grt.* Charlotte Harbor (Sloss.).

Variety **floridalis** *B. and McD.* Everglade, Apr. 26–30 (McD.).

The record for the typical form may be referable to this variety.

Larva on " Florida cranberry."

Reported also from Colorado.

Loxostege nasonialis *Zell.* Lakeland (McD.).

Occurs in Texas.

Diasemia ramburialis *Dup.* Lakeland, Fort Myers (McD.).

Distributed over the South Atlantic States. Occurs also in Europe and Australia. According to Hampson it is " universally distributed."

Diasemia nigralis *Fern.* Charlotte Harbor (Sloss.); Fort Myers (McD.); Everglade (McD.), Apr. 6 (A. M. N. H.).

Known only from Florida.

Diasemia janassialis *Wlk.* " Florida " (Dyar).

Known only from Florida.

Diasemia magdalena *Fern.* " Florida " (Dyar).

Occurs in Texas.

Microcausta flavipunctalis *B. and McD.* Fort Myers, Apr. 1–7 (McD.).

Known only from Florida.

Tholeria reversalis *Gn.* Indian River (A. M. N. H.); Lake Worth (Dyar); Charlotte Harbor (Sloss.); Boca Grande, Apr., Useppe, Apr. (Ds.); Punta Rassa, Apr. 3 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville (Coll. Agric. Exp. Sta.); Crestview, Oct. 16; De Funiak Springs, Oct. 17].

Larva on *Sophora tomentosa* and *Baptisia tinctoria.*

Extends through the Atlantic States to New York and southward into the Antilles.

Phlyctænia ferrugalis *Hbn.* Indian River (A. M. N. H.).

Extends to Quebec. Occurs also in Europe and Asia.

Phlyctænia helvalis *Wlk.* " Florida " (Hulst).

Larva on " broad-leaf willow."

Extends to Quebec and Colorado.

Phlyctænia tertialis *Gn.* Fort Myers, Apr. 1 (A. M. N. H.); [Agric. Exp. Sta. grounds, Gainesville, Sept. 26 ; Gainesville, Sept. 26].

Larva on *Vaccinium.*

Extends to Quebec.

Phlyctænia desistalis *Wlk.* Fort Myers, common (McD.).

Occurs in Texas and Brazil.

Cindaphia bicoloralis *Gn.* [Monticello, Oct. 7.

Extends to New York and South America.]

Epicorsia mellinalis *Hbn.* Lake Worth (Dyar, Sloss.); Charlotte Harbor, Biscayne Bay (Sloss.).

Larva on *Citharexylum villosum.*

Extends through the Antilles to South America.

Pyrausta æglealis *Wlk.* Marco, Nov. 4 (A. M. N. H.).

Larva on pokeberry.

Extends to Quebec.

Pyrausta thestealis *Wlk.* South Bay, Lake Okeechobee, Apr. 30 (A. M. N. H.), May 1 (Ds.).

Larva on *Clethra alnifolia.*

Extends to New Jersey.

Pyrausta theseusalis *Wlk.* Lakeland, May 4 (Ds.); Fort Myers (McD.), Apr. 23 (A. M. N. H.); Marco (McD.), Apr. 11 (A. M. N. H.).

Larva on fern.

Extends to Quebec.

Pyrausta oxydalis *Gn.* [Devils Mill Hopper, Gainesville, Sept. 27.

Extends through the Atlantic States and to South America.]

Pyrausta orphisalis *Wlk.* Pablo Beach, Nov. 4 (A. M. N. H.); [Devils Mill Hopper, Gainesville, Sept. 27; East Gainesville, Sept. 28; Monticello, Oct. 5, 7; De Funiak Springs, Oct. 17].

Larva on *Monarda fistulosa.*

Extends to Quebec.

Pyrausta submedialis *Grt.* "Florida" (Dyar).

Extends to Canada, Illinois and Arizona.

Pyrausta illibalis *Hbn.* Lakeland (McD.).

Larva on plant with Ficus-like leaf (McD.).

"The two specimens taken agree far more closely with Hubner's figure than do the specimens from the north that commonly go under this name. The Florida species is white, sparsely speckled with brown, with yellow-brown costa, small round orbicular and large elongate reniform." (McD.).

Extends to Canada.

Pyrausta penitalis *Grt.* [Gainesville, Sept. 27, 29, Oct. 2.

Extends through the Atlantic States to New Jersey.]

Pyrausta phœnicealis *Hbn.* Indian River (A. M. N. H.); Fort Myers (McD.), Mar. 31, Apr. 23 (A. M. N. H.); [East Gainesville, Sept. 28; Bayou Chico, Pensacola, Oct. 12].

Extends to Quebec and through Mexico and the Antilles to South America. Occurs also in central and southern Africa, and in the Oriental and Australian regions.

Pyrausta acrionalis *Wlk.* Lakeland, May 4 (A. M. N. H.); Fort Myers (McD.).

Extends to New Jersey.

Pyrausta laticlavia *G. and R.* Jacksonville, Nov. 5 (A. M. N. H.); Lakeland, May 5, 7 (A. M. N. H., Ds.); Fort Myers (McD.), Mar. 31, Apr. 22, 24 (A. M. N. H.); Everglade, Apr. 14 (A. M. N. H.); [Gainesville, Oct. 2; Monticello, Oct. 5; Crestview, Oct. 15].

Extends to Pennsylvania, Texas and California.

Pyrausta tyralis *Gn.* Lakeland, May 4 (Ds.); Lake Worth (Dyar); Charlotte Harbor (Sloss.); Fort Myers (McD.); Allen River to Deep Lake, Apr. 14 (A. M. N. H.); Everglade (McD.), Apr. 6, 10, 11 (A. M. N. H., Ds.); Biscayne Bay (Sloss.).

Larva on *Psychotria undata.*

Extends to Illinois, Texas and through Mexico to Brazil. Occurs also in Cuba.

Pyrausta inornatalis *Fern.* "Florida" (Hulst).

Extends to Texas and Mexico.

Pyrausta signatalis *Wlk.* [Gainesville, Oct. 2.

Extends to New Jersey, Missouri and Texas.]

Eustixia pupula *Hbn.* Charlotte Harbor (Sloss.).

Extends to New Jersey. Occurs also in Brazil.

Stenoptycha pterophoralis *Wlk.* (*solanalis* B. and McD.). Everglade, Apr. 16, 23 (McD.).

Larva on *Solanum* sp.

Occurs in the Antilles.

Lineodes contortalis *Gn.* Lake Worth (Dyar).

Extends to Texas and through Mexico to Brazil.

Lineodes integra *Zell.* Lake Worth (Dyar); Everglade (McD.), Apr. 8 (A. M. N. H.).

Larva on *Solanum radula* and cultivated *S. jasminifolium.*

Extends to Missouri and California. Occurs also in Brazil.

Lineodes interrupta *Zell.* Biscayne Bay (Sloss.).

Occurs in Texas.

Lineodes triangulalis *Moesch.* Lake Worth (Dyar).

Larva on *Capsicum frutescens.*

Occurs in the Antilles.

NYMPHULINÆ.

Nymphula maculalis *Clem.* Jacksonville (Sloss.); Indian River (A. M. N. H.); Lake Worth (Dyar); Cocoanut Grove (Schwarz); Everglade (McD.), Apr. 6 (A. M. N. H.); Biscayne Bay (Sloss.).

Variety **fœminalis** *Dyar.* Palm Beach, Jan. 25 (Dyar).

Variety **masculinalis** *Dyar.* Cocoanut Grove (Schwarz).

Larva on water lilies.

Extends to Massachusetts, Ontario and Illinois.

Nymphula allionealis *Wlk.* Lake Worth (Dyar); Fort Myers, common (McD.), Apr. 1, 22, 23, 24 (A. M. N. H., Ds.), Nov. 12 (A. M. N. H.); Allen River to Deep Lake, Apr. 12 (A. M. N. H.); Everglade (McD.), Apr. 6, 9, 11, very common (A. M. N. H., Ds.); Palm Beach, Cocoanut Grove, Miami, Mar., Aug. (Barnes, Schwarz, Dyar, Caudell); Biscayne Bay (Sloss.).

Extends to Massachusetts, Quebec and Wisconsin.

Nymphula obscuralis *Grt.* Charlotte Harbor (Sloss.).

Larva on *Vallisneria spiralis* and *Potamogeton natans.*

Extends to New York and Wisconsin.

Nymphula obliteralis *Wlk.* "Florida," Mar. (Dyar); Lakeland, May 8 (A. M. N. H.); Lake Worth (Dyar); Fort Myers, common (McD.); La Belle, Apr. 26 (Ds.); Everglade (McD.), Apr. 6, 7 (A. M. N. H.), Apr. 11 (Ds.); Chokoloskee (Barnes); Palm Beach, Feb. 4 (Dyar); West Palm Beach, Green Cove Springs, Mar. (Dyar and Caudell).

Larva on *Lemna.*

Dyar's specimens collected in "Florida, Mar.," were reared from aquatic larvæ on water lilies. On a specimen in the Museum is a note to the effect that it (the moth) was hatched from a pupa from the under side of a pond lily. Hart says the favorite home of the species is among the floating leaves of *Potamogeton natans.*

Extends to Quebec, Illinois and through Texas to California. Occurs also in Central America.

Nymphula nomophilalis *Dyar.* Hastings, Apr. (Kearfott); Charlotte Harbor, Mar., Lake Worth (Sloss.); Everglade (McD.), Apr. 6, 7, 9, 11 (A. M. N. H., Ds.); Cocoanut Grove (Schwarz).

Occurs in Texas.

Nymphula gyralis *Hulst.* Crescent City (Hubbard); Palm Beach, Feb. 16 (Dyar); Everglade (McD.), Apr. 6, 7, 11 (A. M. N. H.), Apr. 15 (Ds.); Chokoloskee (Barnes).

Extends to Massachusetts, Illinois and Missouri.

Nymphula nebulosalis *Fern.* Hastings, Apr. (Kearfott), May (Hulst); Lakeland, May 8, Nov. 8 (A. M. N. H.), Nov. 9 (Ds.); [Monticello, Oct. 8].

Known only from Florida.

Nymphula icciusalis *Wlk.* Charlotte Harbor (Sloss.); La Belle, Apr. 27 (A. M. N. H.); Biscayne Bay (Sloss.); [Gainesville, May 10, Aug. 28 (Coll. Agric. Exp. Sta.); Crestview, Oct. 15].

Extends to Maine, Quebec and Wisconsin. Occurs also in South America.

Nymphula australis *Hulst.* "Florida" (Hulst).

Known only from Florida.

Oligostigma seminealis *Wlk.* Fort Myers (McD.); La Belle, Apr. 27, Everglade, Apr. 6, 7 (A. M. N. H.); Cocoanut Grove (Schwarz).

Our females have the primaries suffused with ochreous and show the white banding less distinctly than in the males.

Extends to Pennsylvania.

Oligostigma vittatalis *Dyar.* Hastings, Apr. (Kearfott); Biscayne Bay (Sloss.).

Known only from Florida.

Ambia striatalis *Dyar.* Charlotte Harbor, Mar. (Sloss.).

Known only from Florida.

Elophila bifascialis *Rob.* Charlotte Harbor (Sloss.).

Extends to Maryland and New Mexico.

Elophila drumalis *Dyar.* Fort Drum (U. S. Dept. Agric.).

Known only from Florida.

Elophila claudialis *Wlk.* Hastings, June (Hulst); Fort Drum (U. S. Dept. Agric.); Fort Myers (McD.); Chokoloskee (Barnes).

Extends to Pennsylvania, Illinois and Missouri. Occurs also in the Antilles.

Elophila slossonalis *Dyar.* Glenwood (Barnes); Indian River (A. M. N. H.); Lakeland, common (McD.); Charlotte Harbor, Mar. (Sloss.); Everglade, common (McD.), Apr. 6, 7, 9, 10 (A. M. N. H.).

Known only from Florida.

Elophila fulicalis *Clem.* Archer, Mar. 9 (Koebele); Lakeland, May 7 (A. M. N. H.); Fort Myers (McD.).

Extends to Massachusetts, Quebec, Washington, New Mexico and Mexico.

Geshna cannalis *Quaint.* Lake City, Nov. 25 (Quaintance); Lake Worth, Feb., Mar. (Dyar); Marco, larvæ, pupæ and adults, Apr. 21, 25 (A. M. N. H., McD.).

Larva on *Canna flaccida* and *C. indica.*

Known only from Florida.

Piletocera bufalis *Gn.* Charlotte Harbor, Lake Worth, (Sloss.); Miami (Sloss., Schaus); Everglade (McD.); Chokoloskee (Barnes).

Extends through the Antilles to South America. Occurs also in Panama.

Piletocera simplicialis *B. and Mc D.* Lakeland, May 7 (A. M. N. H.); Marco, Apr. 17 (A. M. N. H., Ds.); Everglade, Apr. 6–15, very common (A. M. N. H., McD.); Chokoloskee (Barnes).

Extends through the Antilles to South America. Occurs also in Panama.

Stenia indianalis *Dyar.* Marco, Apr. 17 (A. M. N. H.).

Known only from Florida.

Steniodes gelliasalis *Wlk.* Archer, Dec. 3 (Koebele); Lake Worth (Sloss.); Marco (McD.).

Extends to Texas and through the Antilles to Brazil.

SCOPARIINÆ.

Scoparia basalis *Wlk.* Archer, Dec. 3 (Koebele).

Extends to Hudson Bay and Missouri.

Forms of this species are found in the western states from British Columbia to Arizona.

Scoparia strigalis *Dyar.* Everglade, Apr. 17 (Ds.).

Extends to Ontario.

PYRALINÆ.

Pyralis farinalis *Linn.* Jacksonville (Sloss.).

Larva in stored products, chiefly grain.

Distributed throughout the United States and Canada and occurs also in Europe and Asia.

Pyralis manihotalis *Gn.* Fort Myers (McD.); Miami (Schaus).

Extends through Mexico and the Antilles to South America. Occurs also in the Oriental and Australian regions.

Herculia sordidalis *B. and McD.* Fort Myers, Apr. 1–7 (McD.).

Known only from Florida.

Omphalocera cariosa *Led.* Jacksonville (Sloss.); Lakeland, May 8 (Ds.); Charlotte Harbor (Sloss.); Fort Myers (McD.); Marco, Apr. 17, larva (A. M. N. H.).

Larva on *Anona triloba.*

"Larvæ were common on a species of *Anona.* They live in long silken tubes thatched with dry leaves and excrement. The mature larva may be described as follows: Head black, spotted with pale ochreous. Body deep orange with a broad black subdorsal band extending laterally to just above stigmata; the dorsal margin of this band has a small orange incision about the center of each segment and immediately anterior and posterior to this are several pale yellow dots; below these near lower margin of band a broken yellow longitudinal line; faint pale dorsal and subdorsal lines, the former best defined on the black prothoracic plate, the latter bordering dorsally the black band; prothoracic plate large, black, dotted with pale yellow; spiracles ochreous, ringed with black, slight black markings laterally in the folds of the skin above tubercle VII. Length, 30 mm." (McD.).

Extends to New Jersey and Alabama. Occurs also in Cuba and South America.

CHRYSAUGINÆ.

Cordylopeza nigrinodis *Zell.* (*Galasa rubidana* Auct.). Lake Worth (Dyar); Fort Myers, Apr. 1 (A. M. N. H.); Everglade (McD.), Apr. 7 (A. M. N. H.).

Extends to New Hampshire and through Texas to the Rocky Mountains. Occurs also in Mexico and the Antilles.

Tosale oviplagalis *Wlk.* "Florida" (Dyar).

Extends to Pennsylvania, Illinois, Arizona and through the Antilles to South America.

Chalinitis olealis *Rag.* "Florida" (Dyar).

Known only from Florida.

Arta statalis *Grt.* "Florida" (Hulst).

Extends to New York and Arizona.

Parachma ochracealis *Wlk.* Florida (Hulst).

Extends to Arizona.

Parachma nua *Dyar.* [Lakeland, Mar. (C. N. Ainslie).

Known only by the type.]

Macrothea unicoloralis *B. and McD.* Everglade (McD.).

Known only from Florida.

SCHŒNOBINÆ.

Patissa xantholeucalis *Gn.* "Florida" (Fernald).

Occurs in Georgia and in Brazil.

Patissa flavicostella *Fern.* "Florida" (Fernald).

Known only from Florida.

Patissa vestaliella *Zell.* Fort Myers, not rare (McD.).

Occurs in Texas.

Patissa flavifascialis *B. and McD.* Fort Myers, May 1–7 (McD.).

Known only from Florida.

Patissa sordidalis *B. and McD.* Everglade, Apr. 8–15 (McD.).

Known only from Florida.

Rupela albinella *Cram.* (*Scirpophaga*). Fort Myers, Mar. 30 (Ds.); South Bay, Lake Okeechobee, Apr. 30, May 1, very common, Allen River to Deep Lake, Apr. 12, not rare (A. M. N. H., Ds.); Everglade (McD.), Apr. 9 (A. M. N. H.), Apr. 14 (Ds.).

McDunnough would place this species in the genus *Patissa* on the strength of vein 10 being stalked with 8 and 9 instead of arising free from the cell as in *Scirpophaga*. He apparently overlooks the fact, however, that in *Patissa,* veins 11 and 12 become coincident toward the costal margin whereas in *albinella* these veins merely anastomose before the costa or are entirely separate. Of the seventeen specimens before me, four from Florida and five from New Jersey, have the veins united before the costa, while in seven from Florida and one from New Jersey, they are separate. The species, therefore, is scarcely referable to *Patissa* and I use the name which Dyar has more recently resurrected from the synonymy of *Scirpophaga.*

The species extends through Mexico and the Antilles to South America.

Rupela unicolor *B. and McD.* (*Storteria*). Everglade, Apr. 8–15 (McD.); Miami (Dyar).

Occurs in South America.

The venation of *Storteria* agrees with those specimens of *albinella,* the type of *Rupela,* in which veins 11 and 12 of the fore wings are separate.

Scirpophaga perstrialis *Hbn.* Lakeland, May 8 (Ds.); Lake Worth (Sloss.); Fort Myers (McD.), Mar. 30 (Ds.), Apr. 22 (A. M. N. H.); La Belle, Apr. 26, 27 (A. M. N. H., Ds.).

Occurs in the Antilles.

Scirpophaga consortalis *Dyar.* (*Argyria*). Fort Myers (McD.); Dade City (Merrick).

Known only from Florida.

Dr. McDunnough says: "This species should be referred to *Scirpophaga.* One of the types from the Merrick collection is before us and neither it nor our very perfect specimen show pectinations of the median vein of secondaries. We should not be surprised if this species proved to be a variety of *perstrialis* without the median white stripe." Dr. Dyar has also examined the type in the National Museum and is in agreement with Dr. McDunnough as to the generic reference.

Schœnobius sordidellus *Zinck.* "Florida" (Dyar).

Extends to New Jersey and Illinois.

Schœnobius unipunctellus *Rob.* Indian River (A. M. N. H.); Fort Myers (McD.); Everglade, Apr. 6–15, common (A. M. N. H., Ds.).

Extends to New Jersey, Illinois and Texas.

Schœnobius tripunctellus *Rob.* Jacksonville, Biscayne Bay (Sloss.).

Extends to New Jersey and Texas.

Schœnobius melinellus dispersellus *Rob.* Indian River (A. M. N. H.); Everglade, common (McD.).

The typical form occurs with the variety in the Atlantic States but does not extend with it westward. The species extends northward to Maine and westward to Texas.

The identification of the Everglade specimens is not altogether certain. Dr. McDunnough says with regard to them: "The males are dark fuscous with darker costa and terminal dots only on the primaries; the females rather light straw, variable, with black dash either present or absent; the discal dot is present, and subterminal row of dots mostly wanting; secondaries without terminal dots. This may represent a new form. We have a similar form from Brownsville, Texas."

CRAMBINÆ.

Prionapteryx nebulifera *Steph.* Jacksonville (Sloss.).

The larvæ construct tubes of sand at base of *Dendrium buxifolium* and *Vaccinium.*

Extends to Long Island and Texas.

Prionapteryx achatina *Zell.* Biscayne Bay (Sloss.).

Extends to New Jersey and Arizona.

Eugrotea dentella *Fern.* "Florida" (Fernald); Fort Myers (McD.).

Known only from Florida.

Crambus satrapellus *Zinck.* La Grange, Sept. 9 (Sleight); Lakeland, May 7 (A. M. N. H.); Fort Myers (McD.), Apr. 1 (A. M. N. H.); Marco (McD.).

Extends to New Jersey and Texas.

Crambus hastiferellus *Wlk.* Lake Worth (Dyar).

Extends to Nova Scotia and California.

Crambus extorralis *Hulst.* Fort Myers (McD.); Chokoloskee (Barnes).

Occurs in Louisiana.

Crambus multilinellus *Fern.* "Florida" (Fernald, A. M. N. H.).

Known only from Florida.

Crambus teterrellus *Zinck.* Fort Myers, Apr. 23, La Belle, Apr. 26, 27 (A. M. N. H., Ds.); Everglade, common (McD.), Apr. 6–15 (A. M. N. H., Ds.).

Extends to Maine, Missouri and Texas.

Crambus decorellus *Zinck.* Lakeland, May 7 (A. M. N. H.); Fort Myers, common (McD.), Apr. 26 (Ds.); La Belle, Apr. 27 (A. M. N. H.).

Extends through the Atlantic States to Massachusetts.

Crambus haytiellus *Zinck.* Fort Myers, Apr. 23 (A. M. N. H.); Everglade (McD.), Apr. 7–15 (A. M. N. H.).

Extends to Texas and the Antilles.

Crambus mutabilis *Clem.* Lake Worth (Dyar); Biscayne Bay (Sloss.).

Larva on grass.

Extends to Canada, Nebraska and Texas.

Crambus extornalis *Wlk.* Jacksonville, Mar. 27, Lakeland, May 8, Fort Myers, Apr. 24, Nov. 1 (A. M. N. H.).

Thaumatopsis floridella *B. and McD.* Punta Gorda, Nov. 16 (A. M. N. H.); Marco, Apr. 16–23, Everglade, Apr. 1–15 (McD.); Key West (Kearf.).

Known only from Florida.

In describing *T. fernaldella* (from New Jersey and the West) Kearfott included a specimen from Key West with a query which Barnes and McDunnough say is probably *floridella.*

Thaumatopsis pectinifer *Zell.* Lakeland (McD.).

Occurs in Texas.

Argyria nivalis *Dru.* Lake Worth (Dyar); Fort Myers (McD.), Mar. 31 (A. M. N. H.); Everglade, Apr. 6–9 (A. M. N. H.).

Extends to Maine, Ontario, Missouri, Mexico and the Antilles.

Argyria argentana *Martyn.* Lakeland, May 7 (A. M. N. H.); Fort Myers (McD.), Apr. 1 (A. M. N. H.).

Extends to New Jersey and Illinois.

Argyria auratella *Clem.* Everglade (McD.).

Extends to Maine, Quebec and California.

Argyria lacteella *Fabr.* Lakeland (McD.), May 7 (A. M. N. H.); Everglade (McD.).

Extends to Texas and through the Antilles to South America. Occurs also in Central America.

Argyria multilineatella *Hulst.* "Florida" (Hulst); Chokoloskee (Barnes).

Extends to Connecticut and Texas.

Argyria differentialis *Fern.* (*Diatræa*). Jacksonville (Sloss.); Fort Myers (McD.), Apr. 22 (Ds.); Everglade, Apr. 15 (A. M. N. H.); Biscayne Bay (Sloss.).

Known only from Florida.

Platytes punctilineella *B. and McD.* Everglade, Apr. 8–15 (McD.).

Known only from Florida.

Diatræa saccharalis *Fabr.* Lake Worth, rare at light (Dyar); Everglade (McD.), Apr. 11 (Ds.).

Larva on sugar-cane and corn.

Extends to South Carolina, Kansas and through Mexico and the Antilles to South America. Dyar says, however, that the specimens from Mexico and the Gulf States, excepting Florida, represent a distinct form. This he has called *crambidoides.*

Iesta lisetta *Dyar.* Fort Myers, common (McD.); La Belle, Apr. 26, 27, common (A. M. N. H., Ds.); Dade City (Merrick).

Known only from Florida.

Chilo densellus *Zell.* Lake Worth, not uncommon (Dyar); Everglade (McD.); Chokoloskee (Barnes).

Extends to Illinois, Texas and Mexico.

Chilo squamulellus *Zell.* Fort Myers, Apr. 23 (A. M. N. H.); Everglade (McD.).

Occurs in Texas.

Chalcœla iphitalis *Wlk.* Charlotte Harbor, Biscayne Bay (Sloss.).

Extends through the Atlantic States to New Jersey. Occurs also in Guatemala.

Dichymolomia pegasalis *Wlk.* "Florida" (A. M. N. H.); Lakeland (McD.); Chokoloskee (Barnes).

Extends to New Jersey and the Antilles.

ENDOTRICHINÆ.

Neodavisia singularis *B. and McD.* Marco, Apr. 17 (A. M. N. H.); Everglade, Apr. 6 (A. M. N. H.), Apr. 8–15 (McD.).

Known only from Florida.

GALLERIINÆ.

Galleria mellonella *Linn.* Indian River (A. M. N. H.); Chokoloskee (Barnes); Biscayne Bay (Sloss.); [St. Augustine (Johnson)].

Larva infests bee hives, eating the wax.

Occurs throughout most of the United States and Canada and in Europe.

EPIPASCHIINÆ.

Epipaschia superatalis *Clem.* Indian River (A. M. N. H.).

Extends to Ontario and Colorado.

Epipaschia interruptella *Rag.* Fort Myers, Mar. 31 (A. M. N. H.).

Occurs also in Arizona.

Epipaschia zelleri *Grt.* Fort Myers (McD.); Biscayne Bay (Sloss.).

Extends to New Jersey, Missouri, Texas and Mexico.

Jocara incrustalis *Hulst.* Lake Worth (Dyar).

Occurs in Colorado.

Jocara perseella *B. and McD.* [Everglade, Apr. 16–23 (McD.).

Larva on alligator pear (*Persea gratissima*) (McD.).

Known only from Florida.]

Tallula atrifascialis *Hulst.* West Park (Sloss.); Indian River (A. M. N. H.); Charlotte Harbor (Sloss.).

Occurs in the Gulf States and Colorado.

Benta malanogrammos *Zell.* "Florida" (Sloss.).

Variety **diluculella** *Grt.* Fort Myers, Mar. 30 (A. M. N. H.), Apr. 22 (McD.).

Extends to New York and Colorado.

Benta floridella *Hulst.* Lake Worth (Dyar); Marco (McD.).

Larva on *Guilandina bonducella* and, according to McDunnough, on a leguminous plant called by the natives of Florida the "knickerbean."

Known only from Florida.

Benta speciosella *Hulst.* "Florida" (Dyar).

Known only from Florida.

Tioga aplastella *Hulst.* "Florida" (Dyar).

Extends to Texas and Colorado.

Tetralopha robustella *Zell.* Lakeland (McD.).

Bred from larva on a trailing leguminous plant; the specimens are small, due probably to underfeeding but agree fairly well with Zeller's description. (McD.).

Occurs in Texas and Colorado.

Tetralopha subcanalis *Wlk.* Fort Myers, Apr. 30 (A. M. N. H.).

Occurs in Texas.

Tetralopha querciella *B. and Mc D.* [Marco, May 15–31 (McD.).

Larva on scrub oak (McD.).

Known only from Florida.]

PHYCITINÆ.

Sarasota plumigerella *Hulst.* Lake Worth (Dyar).

Larva on *Laguncularia racemosa.*

Known only from Florida.

Myelois transitella *Wlk.* "Florida" (Dyar).

Known only from Florida.

Myelois obnupsella *Hulst.* "Florida" (*Hulst*).

Extends through the Atlantic States to Ontario.

Myelois bistriatella *Hulst.* "Florida" (Hulst).

Extends to New York, Wisconsin and Colorado.

Myelois dulciella *Hulst.* Hastings, Oct. 26 (Kearfott).

Known only from Florida.

Myelois duplipunctella *Rag.* "Florida" (Hulst).

Known only from Florida.

Myelois oporedestella *Dyar.* Miami (Busck).

Larva "bred from dried loquat fruits."

Acrobasis comptoniella *Hulst.* Fort Myers (McD.).

Larva on *Comptonia* and *Myrica.*

Extends through the Atlantic States to New Hampshire and Quebec.

Acrobasis evanescentella *Dyar.* Orlando (Dyar).

Larva on pecan.

Known only from Florida.

Acrobasis tenuella *B. and Mc D.* Fort Myers, Apr. 16–23, Everglade, Apr. 8–15 (McD.).

Known only from Florida.

Mineola indigenella nebulella *Riley.* Lakeland (McD.).

Larva on apple, plum and cherry.

Extends to Canada, Iowa and Texas. The typical form is recorded from Quebec.

Dr. McDunnough says: "We bred a number of specimens from larvæ found on a *Cratægus* sp. which correspond closely with Decatur, Illinois specimens also bred from thorn, which we have considered to be *nebulella* Riley. Dyar states (Proc. Ent. Soc. Wash., X, 45) that the type of *nebulella* shows it to belong in the genus *Acrobasis,* but he further states that the food plant is hickory and walnut and it would appear, though the phrasing is rather ambiguous, as if the type before Dyar was one of four specimens bred by Riley from larvæ on these trees. In this case it must be considered spurious, as Riley distinctly states (Fourth Missouri Rept., p. 42) that the single specimen of *nebulella* was bred from wild crab (*Cratægus*)."

Ulophora caricæ *Dyar.* Miami (Yothers).

Larva on papaya.

Known only from Florida.

Piesmopoda subrufella *Hulst.* "Florida," Apr. (Hulst); Fort Myers, Apr. 23, Marco, Apr. 17 (A. M. N. H.); Chokoloskee (Barnes).

Known only from Florida.

Piesmopoda filiolella *Hulst.* "Florida" (Dyar).

Occurs in Texas.

Dioryctria clarioralis *Wlk.* Fort Myers (McD.).

Described from the "United States." Known definitely only from Florida.

Monoptilota nubilella *Hulst.* "Florida" (Hulst).

Extends through the Atlantic States to Maryland.

Pinipestis amatella *Hulst.* "Florida" (Hulst).

Known only from Florida.

Glyptocera consobrinella *Zell.* "Florida" (Hulst).

Extends to Quebec and Texas.

Nephopterx pergratialis *Hulst.* "Florida" (Hulst).

Occurs in Georgia.

Nephopteryx furfurella *Hulst.* "Florida" (Hulst).

Extends to Texas.

Tlascala finitella *Wlk.* "Florida" (Hulst); Fort Myers (McD.).

Extends to Nova Scotia and Colorado.

Meroptera pravella *Grt.* Fort Myers (McD.).

Larva on *Rhus* (McD.) and *Salix.*

Extends to Ontario and Colorado.

Immyrla bumeliella *B. and McD.* Fort Myers, Apr. 24–30, May 1–7 (McD.).

Larva on *Bumelia microcarpa* (McD.).

Known only from Florida.

Salebria afflictella *Hulst.* Lakeland (McD.).

Larva on *Liquidambar styraciflua.*

Extends to New Jersey.

Salebria celtidella *Hulst.* "Florida" (Sloss.); Lake Worth (Dyar).

Larva on *Celtis occidentalis.*

Extends through the Atlantic States to New England.

Salebria georgiella *Hulst.* Charlotte Harbor (Sloss.).

Known only from Florida.

Salebria slossonella *Hulst.* Miami, Feb., Mar. (Sloss.).

Known only from Florida.

Elasmopalpus petrellus *Zell.* "Florida," Apr. (Hulst); Lakeland, May 4 (A. M. N. H.); Charlotte Harbor (Sloss.).

Extends to North Carolina and Colorado. Occurs also in South America.

Elasmopalpus floridellus *Hulst.* Charlotte Harbor (Sloss.); Fort Myers (McD.).

Reported from Arizona.

Elasmopalpus melanellus *Hulst.* "Florida," Apr. (Hulst).

Known only from Florida.

Elasmopalpus lignosellus *Zell.* Lake Worth (Dyar); Fort Myers, Everglade (McD.).

Extends to New Jersey, Texas and through Mexico and the Antilles to Patagonia.

Etiella zinckenella *Treit.* South Bay, Lake Okeechobee, May 2 (A. M. N. H.); Everglade (McD.); Chokoloskee (Ds., McD.).

Larva on *Colutea arborescens* in Europe, and according to McDunnough, on the pods of another leguminous plant, in Florida.

Extends to Canada, Texas and through Mexico and the Antilles to South America. Occurs also in Europe, Western Africa, Madagascar, central Asia and Australia.

Etiella schisticolor *Zell.* "Florida," May (Hulst).

Extends to New York and California.

Etiella rubribasella *Hulst.* "Florida," May (Hulst).

Reported from Colorado.

Melitara prodenialis *Wlk.* Lake Worth (Sloss.); Fort Myers (McD.).

[Larva in prickly pear.]

Extends to New Jersey, Colorado, Texas and through Mexico and the Antilles to South America.

Euzophera semifuneralis *Wlk.* "Florida" (Hulst).

Extends to Canada, Washington and Utah. Occurs also in South America.

Seneca tumidulella *Rag.* "Florida" (Hulst).

Known only from Florida.

Lætilia coccidivora *Comst.* Everglade (McD.), Apr. 6 (A. M. N. H.); Chokoloskee (Barnes).

Larva feeds upon the cottony maple scale and the tulip soft scale.

Extends to New Jersey and Arizona.

Mescina (?) **estrella** *B. and McD.* Marco, Apr. 17 (A. M. N. H.); Everglade, Apr. 8–15 (McD.).

Known only from Florida.

Divitiaca ochrella *B. and McD.* Marco, Apr. 17 (A. M. N. H.); Everglade, Apr. 8–15 (McD.), Apr. 11 (A. M. N. H.).

Known only from Florida.

Divitiaca simulella *B. and McD.* Fort Myers, Apr. 23 (A. M. N. H.); Everglade, Apr. 8–15 (McD.), Apr. 9–10 (A. M. N. H.).

Known only from Florida.

Divitiaca parvuella *B. and McD.* Marco, Apr. 16–23 (McD.), Apr. 17 (A. M. N. H.).

Known only from Florida.

Hulstia dulciella *Hulst* (*Honora*). Lake Worth (Dyar).

Known only from Florida.

Dolichorrhinia planatella, new species.

Expanse, 15–17 mm. Palpi and head griseous, antennæ brown. Thorax griseous with a pinkish tinge. Abdomen yellowish with a white dorsal patch on the second segment. Primaries whitish to pale gray. Transverse anterior line brown, over one-third out, dentate and continuous (female) or punctiform (male), preceded on the inner margin by a rufous patch and before this near the inner margin a conspicuous black spot in the male and a diffuse, vague dark spot in the female. Extreme basal area again pinkish. Two small black spots at the end of the cell, conspicuous in the male, vague or absent in the female. Transverse posterior line brown, oblique, situated midway between the discal spots and outer margin, waved, rather diffuse in both sexes. A pinkish shade sometimes runs through the subterminal area and for a short distance along the inner margin. Terminal line black, punctate. Secondaries yellowish-brown, glistening, the edges and apex marked with deeper brown, which color also lines the veins to some slight extent. Beneath smoky, glistening, the primaries somewhat darker than the secondaries and slightly tinged with pink.

Described from three males and five females, a pair of which have been deposited in the National Museum.

Habitat: Fort Myers, Apr. 1, 23; Marco, Apr. 17; Everglade, Apr. 6, 10, 11.

Easily distinguished from the only other species referred to the genus by the absence of the orange color to the transverse anterior line and by the presence of the black spots at the end of the cell and on the inner margin.

Diviana eudoriella *Rag.* Everglade (McD.).

Extends to North Carolina.

Diviana verecuntella, new species.

Expanse, 15–18 mm. Palpi pinkish, end member usually brown and the under side of second joint near the apex also brown. Thorax and abdomen pinkish-ochreous, the former marked with a few brown scales, the latter frequently entirely pale brown on the basal segments. Primaries pale yellowish, more or less overlaid with brown and deep ochreous scales. Transverse anterior line white, over one-third out, oblique, sharply dentate, defined, preceded on the inner margin by a large ochreous patch which is overlaid with deep brown scales collected chiefly on the anal and cubital veins. Discal spot small, brown, conspicuous, sometimes with a smaller one immediately above it. Transverse posterior line white, irregularly waved, more or less defined by ochreous shades on each side of it. Terminal line brown, punctiform. Secondaries pale smoky, glistening, margin somewhat darker, fringes paler. Beneath rather uniform smoky.

Described from seven females taken at Fort Myers, Apr. 1, 10 and Everglade, Apr. 10, 15. One of the specimens from Everglade was collected by Mr. Wm. T. Davis and the cotype is in his collection; another cotype has been deposited in the National Museum.

This species is distinguished from *D. eudoriella* Rag., the only other species of the genus, by the pale instead of blackish ground color and by the very different ornamentation.

Ocala dryadella *Hulst.* Charlotte Harbor (Sloss.); Everglade (McD.).

Known only from Florida.

Palatka nymphæella *Hulst.* Charlotte Harbor (Sloss.).

Known only from Florida.

Wunderia, new genus.

Labial palpi long, slender, ascending, third member two-thirds as long as second; maxillary palpi pointed, reaching to middle of second joint of labial palpus; tongue strong; antennæ simple; ocelli present, small; front projected forward in the form of a flat cone. No thoracic nor abdominal tuftings. Legs normal. Primaries 10 veins. R_1, R_2, M_1 and Cu_2 from cell, R_{3+4} and R_5, and M_3 and Cu_2 long stemmed, M_2 absent; secondaries 9 veins, M_2 absent, subcosta and radius, and M_3 and Cu, long stemmed, cross-vein absent. See figure.

Type: *Wunderia neæriatella* Gross.

This genus, which I dedicate to my friend Mr. Chas. Wunder, is closely allied to *Eurythmidia* of Ragonot, but lacks all trace of a cross vein on the secondaries.

Wunderia neæriatella, new species.

Expanse, 14.5 mm. Basal segments of palpi yellowish, end member dark brown. Head and body yellowish, the abdomen marked on the dorsum by a broken brown stripe which tends to become connected on the apical segments. Ground color of primaries soiled yellowish overlaid with pink scales on the costal and inner areas and with brown ones on the median area. A transverse brown and poorly defined line over one-third out on wing, waved, extending inward at either end but not reaching the costa or inner margin. Half way between this line and the outer margin in the center of the wing are two distinct brown spots, one below the other. Costa near apex narrowly whitish. Fringes pale whitish-gray on apical half, brown near and at anal angle. Secondaries subdiaphanous, very pale brownish, the outer edge narrowly margined with darker brown. Fringes concolorous with the ground color of wing. Beneath immaculate.

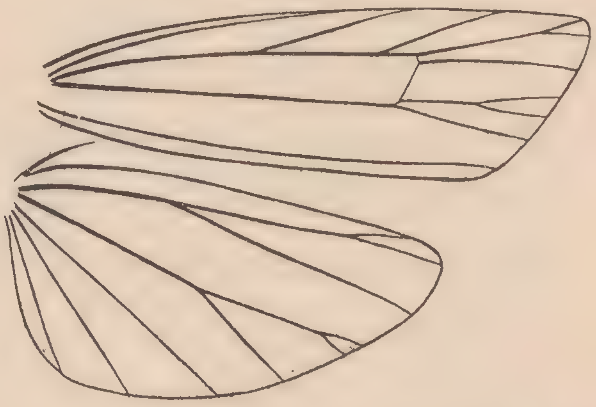


Fig. 1. Venation of *Wunderia neæriatella* gen. et sp. nov.

One female from Everglade, Apr. 6.

Homœosoma electellum *Hulst.* (*differtella* B. and McD.). Fort Myers (McD.); Everglade, Apr. 8–15 (McD.), Apr. 10 (A. M. N. H.).

Extends to New Jersey and New Mexico.

Homœosoma uncanale *Hulst.* "Florida" (Dyar).

Extends to Quebec and Nevada.

Homœosoma stypicellum *Grt.* Marco, Apr. 17, Everglade, Apr. 6 (A. M. N. H.).

Extends to Quebec and Texas.

Varneria atrifasciella *B. and McD.* Everglade, Apr. 8–15 (McD.).

Known only from Florida.

ANERASTINÆ.

Trivolusia roseopennella *Hulst.* Volusia Co. (Hulst).

Known only from Florida.

Peoria approximella *Wlk.* Everglade (McD.); Biscayne Bay (Sloss.).

The Everglade specimens are very pale without much pink; vein 4 of secondaries is often entirely coalesced with 3. (McD.)

Extends to Ontario and Colorado.

Alamosa bipunctella *B. and Mc D.* Fort Myers, Apr. 16–23 (McD.).

Known only from Florida.

Hypsotropa luteicostella *Rag.* "Florida" (Hulst); Marco, Apr. 17 (A. M. N. H.).

Known only from Florida.

Wekiva nodosella *Hulst.* "Florida," Apr. (Hulst).

Known only from Florida.

Homosassa ella *Hulst.* "Florida" (Hulst); Everglade, Apr. 6 (A. M. N. H.).

Known only from Florida.

Dannemora edentella *Hulst.* "South Florida," Apr. (Hulst).

Known only from Florida.

Bandera carneela *B. and Mc D.* Everglade, Apr. 8–15 (McD.).

Known only from Florida.

Tampa dimediatella *Rag.* "Florida" (Hulst).

Occurs in Texas.

Statina roseotinctella *Rag.* "Florida" (Hulst).

Occurs in Texas.

Calera (?) albicostella, new species.

Expanse, 19–20 mm. Palpi pale pinkish, white beneath and at tips; thorax pinkish; abdomen yellowish. Primaries uniformly pale pink with a faint orange cast, except for a rather broad white band along the costa which becomes somewhat narrower toward the apex. Secondaries uniformly whitish, glistening. Beneath as above but the white on costa scarcely evident.

Two females from Fort Myers, Apr. 23 and Everglade, Apr. 7.

This species was placed for me by Dr. Dyar in the above genus to which it runs perfectly by Hulst's table in his revision of the North American Phycitidæ, but in the description of the genus, Hulst says that veins 3 and 4 (=Cu_1 and M_3) of the fore wings are stemmed whereas in the present species these veins arise separately from the cell. In this latter respect our species fits *Peoria* Rag. but differs again from the venation of this genus in that vein 4 (=M_3) of the hind wing is entirely absent instead of being present and stemmed with vein 3 (=Cu_1). I hesitate to erect new genera on apparently unimportant differences of venation, so for the present I leave the species in *Calera* (with which it agrees in every other detail of structure) rather than in *Peoria* which differs further in the possession of ocelli.

In appearance *albicostella* is much like *Peoria approximella* but the wings are narrower and more pointed and the pink is much less intense. From *Calera punctilimbella* it differs chiefly in the absence of the terminal line of black points.

Chipota perlepidella *Hulst.* "Florida" (Hulst).

Known only from Florida.

PTEROPHORIDÆ.

Trichoptilus lobidactylus *Fitch.* Lakeland, Fort Myers (McD.); Everglade, Apr. 9 (A. M. N. H.); Chokoloskee (Barnes, McD.).

Larva on *Solidago canadensis.*

Extends to Massachusetts and California.

Trichoptilus centetes *Meyer.* Chokoloskee (Barnes).

Occurs in the Antilles, New Guinea and Australia.

Platyptilia edwardsii *Fish.* Biscayne Bay (Sloss.).

Extends to Maine and Quebec.

Platyptilia crenulata *B. and McD.* Fort Myers, Apr. 23 (A. M. N. H.), May 1–7 (McD.); Everglade, Apr. 1–15 (McD.), Apr. 7 (A. M. N. H.); Chokoloskee (Barnes).

Known only from Florida.

Pterophorus bipunctatus *Moesch.* Everglade (McD.).

"The specimen lacks any trace of brown scaling before anal angle of primaries but otherwise agrees exactly with description." (McD.).

Occurs in the Antilles.

Pterophorus kellicottii *Fish.* Everglade, Apr. 8 (A. M. N. H.).

Larva on *Solidago.*

Extends to Quebec.

Pterophorus rhynchosiæ *Dyar.* Miami (Dyar).

Larva on *Rhynchosia.*

Known only from Florida.

Pterophorus monodactylus *Linn.* Lake Worth (Dyar); South Bay, Lake Okeechobee, May 2 (A. M. N. H.).

Larva on *Ipomœa hederacea, Convolvulus sepium, C. arvenis, Chenopodium album* and *Atriplex patula.*

Extends to Maine and California. Occurs also in Europe, northern Africa and western Asia.

Pterophorus cervinicolor *B. and McD.* Everglade, Apr. 8–15 (McD.); South Bay, Lake Okeechobee, May 2 (A. M. N. H.).

Known only from Florida.

Pterophorus inquinatus *Zell.* Fort Myers, Everglade (McD.); Chokoloskee (McD., Barnes).

Larva on *Ambrosia artemisiæfolia.*

Extends to Missouri and Arizona. Occurs also in the Antilles.

Pterophorus unicolor *B. and McD.* Marco, Apr. 20 (A. M. N. H.), Apr. 24–30 (McD.).

Larva bores in stems of *Eupatorium* sp. (McD.).

Known only from Florida.

Pterophorus simplicius, new species.

Expanse, 11.5 mm. Head pale yellowish, tinged with brownish especially on the vertex; palpi white, brown apically; thorax pale straw-yellow, the tips of the patagia white, fore and mid-legs yellowish, the inner side of the tibiæ and part of tarsus brown, hind legs wholly whitish; abdomen yellowish. Primaries very pale straw-yellow, costa with a few brown scales to incision, a small patch of similarly colored scales on costa beyond incision and another near the center of the wing at the incision. A few more brown scales are on the inner edge of both lobes near the apex. Secondaries smoky, immaculate. Beneath uniformly pale smoky.

One specimen from Everglade, Apr. 10.

This species resembles *Pterophorus unicolor* B. and McD. but is smaller, of a less vivid straw-yellow and is marked with brown, a character not possessed by *unicolor* in the slightest degree. The palpi are longer than is usual in *Pterophorus* being more like those of *Stenoptila,* but there is no anal angle on the first lobe of the primaries, and the front is smooth.

Pterophorus perplexus, new species.

Expanse, 14 mm. Head pale ochreous-brown, palpi concolorous but with some dark brown scales outwardly, antennæ whitish annulated with pale brown above; thorax and abdomen whitish, the latter usually with a black point on the posterior edge of each segment above, and with a similar series on the sides which may form a patch on the sixth segment; legs creamy, glistening, fore and middle pairs largely brown on the inner side, the posterior pair marked with brown at the extreme apices of the joints and spurs. Primaries creamy-white shaded with pale ochreous-brown and more or less besprinkled with dark brown atoms, some of which form distinct spots as follows: one on each side of the first lobe near the apex, one at the incision, a larger elongated one on costa above base of incision and two more near the apex of the inner margin of the second lobe. Another smaller spot is formed in the cell half way between base of wing and incision. Fringes dusky. Secondaries uniform pale smoky, the fringes paler. Beneath smoky with some of the apical black spots repeated.

Described from three specimens from La Belle, Apr. 27, Marco, Apr. 17 and Everglade, Apr. 10.

Apparently quite different from any described species.

Stenoptilia pallistriga *B. and Mc D.* Fort Myers, May 1–7 (McD.).

Known only from Florida.

TORTRICIDÆ.

OLETHREUTINÆ.

Bactra lanceolana *Hbn.* Lake Worth (Dyar); Fort Myers, Everglade (McD.).

Occurs throughout the United States and also in the Antilles, Europe, Asia, Africa, Australia and New Zealand.

Bactra verutana *Zell.* Fort Myers, Apr. 23, Everglade, Apr. 7 (A. M. N. H.).

Occurs in Texas.

Olethreutes devotana *Kearf.* Hastings, June 8 (Brown); "Harbor," Mar. (Hulst Coll.).

Known only from Florida.

Olethreutes rosaochreana *Kearf.* "Florida" (Fernald).

Known only from Florida.

Olethreutes andromediana *Kearf.* Fort Myers, Apr. 26 (A. M. N. H.).

Known only from Florida.

Phæcasiophora confixana *Wlk.* Enterprise, Apr. (Castle and Laurent).

Extends through the Atlantic States to New Jersey.

Eucosma circulana *Hbn.* Fort Myers, Apr. 22 (A. M. N. H.).

Occurs in the Southern States.

Eucosma quinquemaculana *Rob.* Biscayne Bay (Sloss.).

Extends through the Atlantic States to New Jersey.

Eucosma ochraceana *Fern.* Lake Worth (Dyar); Palm Beach (U. S. N. M.).

Adults resting on *Iva imbricata* (Dyar).

Known only from Florida.

Eucosma giganteana *Riley.* South Bay, Lake Okeechobee, May 2 (A. M. N. H.).

Extends to New Hampshire and Kansas.

Eucosma lineana *Fern.* Lake Worth (Dyar).

Larva on *Anona laurifolia.*

Known only from Florida.

Eucosma constrictana *Zell.* "Florida" (Dyar).

Extends to Texas.

Eucosma strenuana *Wlk.* Lake Worth (Dyar); Fort Myers (Mc.D.).

Larva in stems of *Ambrosia trifida.*

Extends to Quebec.

Eucosma perplexana *Fern.* Lake Worth (Dyar); Everglade, Apr. 6, 10 (A. M. N. H.).

Extends to New Jersey.

Eucosma desertana *Zell.* Atlantic Beach (Sloss.).

Larva makes gall on stems of *Solidago.*

Extends to New York and Texas.

Eucosma tripartitana *Zell.* Everglade, Apr. 6 (A. M. N. H.).

Larva an inquiline on Cecidomyid gall on *Rudbeckia.*

[Extends to New Jersey and Texas.]

Eucosma floridana *Kearf.* Hastings, Oct. 6–15 (Brown).

Known only from Florida.

Eucosma vandana *Kearf.* Hastings, Mar., Apr., Oct. (Brown).

Known only from Florida.

Eucosma minutana *Kearf.* Everglade, Apr. 6 (A. M. N. H.).

"Larva doubtless in stems of aster or similar plants" (Kearfott).

Extends to New Jersey and Illinois.

Episimus augmentanus *Zell.* Lake Worth (Dyar).

Larva on *Rhus metopium.*

Occurs in the Antilles.

Episimus argutanus *Clem.* Lake Worth (Dyar); Fort Myers (McD.).

Larva on *Euphorbia heterophyla* and *Rhus* sp.

Extends to Connecticut and Texas. Occurs also in the Antilles.

Phthinolophus indentanus *Dyar.* Hastings (Kearf.); Palm Beach (Dyar).

Larva on *Vaccinium* and *Myrica.*

Extends to New Jersey.

Enarmonia tristrigana *Clem.* Marco, Apr. 20 (A. M. N. H.).

Extends to Massachusetts.

Lipoptycha maculana *Fern.* Lake Worth (Dyar).

Larva on *Schœpfiia arborescens.*

Known only from Florida.

TORTRICINÆ.

Epagoge sulphurana *Linn.* (*sulphureana* Clem.). "Florida" (Robinson).

Larva on grape, strawberry, willow and other plants.

Extends to Massachusetts, Quebec, Illinois and Texas.

Epagoge demissana *Wlsm.* "Florida" (Sloss.).

Larva on *Solidago.*

Extends to New Jersey and Texas.

Capua lentiginosana *Wlsm.* Lake Worth (Dyar). Identification somewhat doubtful (Dyar).

Occurs in Texas.

Sparganothis taracana *Kearf.* Hastings, Mar., Apr., Sept., Oct., Nov. (Brown).

Occurs in Texas.

Archips rosaceana *Harr.* "Florida" (Robinson).

Larva on roses and on orchard and small fruits.

Extends to Massachusetts and Colorado.

Archips obsoletana *Wlk.* "Florida" (Robinson).

Extends to New Jersey and Texas.

Archips argyrospila *Wlk.* "Florida" (Sloss.).

Larva a general feeder.

Extends to Quebec and California.

Archips georgiana *Wlk.* Jacksonville (Sloss.); Lakeland (McD.); Lake Worth (Dyar).

Larva on *Chiococca racemosa.*

Occurs in the South Atlantic States and in (?) Brazil.

Platynota flavedana *Clem.* Biscayne Bay (Sloss.).

Larva a general feeder.

Extends to Quebec.

Platynota rostrana *Wlk.* Lake Worth (Dyar).

Larva on *Rivina humilis, Randia aculeata, Gnaphalium purpureum* and *Myrsine floridana.*

Extends through the Antilles to Venezuela.

Platynota tinctana *Wlk.* Biscayne Bay (Sloss.).

Occurs in Texas.

Platynota metallicana *Wlsm.* "Florida" (Dyar).

Known only from Florida.

Tortrix peritana *Clem.* Lake Worth, common (Dyar).

Extends through the Atlantic States to New Jersey.

Tortrix ivana *Fern.* Lake Worth (Dyar).

Larva on *Iva imbricata.*

Known only from Florida.

Tortrix seminolana *Kearf.* Palm Beach (Dyar).

Larva on *Chiococca racemosa.*

Known only from Florida.

Tortrix chioccana *Kearf.* Palm Beach (Dyar).

Larva on *Chiococca racemosa.*

Known only from Florida.

Eulia amatana *Dyar.* Lake Worth (Dyar).

Larva on *Anona laurifolia* and *Nectandra wildenoviana.*

Eulia mariana *Fern.* "Florida" (Dyar).

Larva on *Vaccinium.*

Extends to New Jersey.

PHALONIINÆ.

Phalonia angulatana *Rob.* Everglade (McD.).

Extends to Pennsylvania and Texas.

Phalonia bunteana *Rob.* Lake Worth, common (Dyar).

Extends to New Jersey.

Phalonia ziscana *Kearf.* Hastings, Feb. 26 (Brown).

Known only from Florida.

Phalonia bomonana *Kearf.* Hastings, Mar. 19 (Brown).

Occurs in Illinois.

Pharmacis sartana *Hbn.* "Florida" (Dyar).

Extends to Pennsylvania.

Hysterosia inopiana *Haw.* "Florida" (Sloss.). "Northern United States" and Europe.

YPONOMEUTIDÆ.

Mieza igninix *Wlk.* Charlotte Harbor, Punta Gorda, Feb., larva (Sloss.); Everglade, Apr. 10 (A. M. N. H.); Chokoloskee (Barnes); Key West (Schwarz).

Larva on *Bumelia angustifolia.*

Known only from Florida.

Atteva aurea *Fitch.* "Florida" (Sloss.); [Big Bayou, Pensacola, Oct. 14; De Funiak Springs, Oct. 17, 19; Lake Stanley, De Funiak Springs, Oct. 18.

Extends to New Jersey, Texas and through Mexico to Central America.]

Atteva gemmata *Grt.* Upper Indian River (Neumoegen); Lake Worth (Sloss., Dyar); Miami (Dyar); Biscayne Bay (Sloss.).

Larva on *Simaruba glauca.*

Known only from Florida.

Trichostibas parvula *Hy. Edw.* (*calligera* Zell.). Jacksonville (Ashmead); Greencove Springs (Turner); Indian River (Edwards); Fort Myers, Apr. (Ds.); Cocoanut Grove (Schwarz); Biscayne Bay (Sloss.); [Seabreeze (Coll. Agric. Exp. Sta.)].

Larva on *Persea* sp.

Known only from Florida.

Plutella maculipennis *Curt.* Lake Worth (Dyar); Everglade, Apr. 9 (A. M. N. H.); Biscayne Bay (Sloss.).

Larva on *Bursa* (?) and turnip (Dyar).

Occurs in the United States and Canada and in Europe.

Choreutis carduiella *Kearf.* "Florida" (Dyar).

Extends through the Atlantic States to Quebec.

Variety **busckiella** *Kearf.* Hastings, Mar. 15 (Brown).

Known only from Florida.

Hemerophila dyari *Busck.* Lake Worth (Dyar).

Larva on *Ficus.*

Known only from Florida.

Walsinghamia diva *Riley.* Cocoanut Grove, May (Schwarz); Biscayne Bay (Sloss.).

Larva on *Ficus.*

Known only from Florida.

Walsinghamia slossonia *Fern.* South Bay, Lake Okeechobee, Apr. 30, Marco, Apr. 17, Everglade, Apr. 6 (A. M. N. H.); Biscayne Bay (Sloss.).

Known only from Florida.

Setiostoma xanthobasis *Zell.* Chokoloskee (Barnes).

Larva on *Quercus stellata.*

Extends to New Jersey, Illinois and Texas.

Polyhymno luteostrigella *Cham.* "Florida" (Busck).

Larva on *Cassia chamæchrista.*

Extends to New Jersey and Texas.

GELECHIIDÆ.

Nealyda pisoniæ *Busck.* Palm Beach, larvæ, adults issued Feb. 2 and Feb. 18 (Dyar).

Larva on *Pisonia aculeata.*

Known only from Florida.

Nealyda kinzelella *Busck.* Lake Worth (Dyar).

Larva on *Pisonia obtusata.*

Known only from Florida.

Aristotelia ivæ *Busck.* Palm Beach, larvæ, adults issue Mar. 10–20 (Dyar).

Larva on *Iva frutescens.*

Known only from Florida.

Gnorimoschema terracottella *Busck.* Palm Beach, larvæ, adults issued Mar. 8–10 (Dyar).

Larva on *Iva imbricata.*

Known only from Florida.

Prostomeus brunneus *Busck.* "Florida" (Busck).

Known only from Florida.

Menesta melanella *Murtf.* Jacksonville (Sloss.).

Larva on oak.

Occurs in Missouri.

Trichotaphe flavocostella *Clem.* "Florida" (Sloss.).

Larva on *Aster, Helianthus* and *Solidago.*

Extends to Quebec and Iowa.

Trichotaphe melantherella *Busck.* Palm Beach, larvæ, adults issued in early Mar. (Dyar).

Larva on *Melanthera deltoidea.*

Known only from Florida.

Trichotaphe condaliavorella *Busck.* Palm Beach (Dyar).

Larva on *Condalia ferrea.*

Known only from Florida.

Glyphidocera floridanella *Busck.* Lake Worth (Dyar).

Known only from Florida.

Dichomeris eupatoriellus *Cham.* (*Ypsolophus*). Lake Worth (Dyar).

Larva on *Eupatorium.*

Extends to New York and Arizona.

Dichomeris citrifoliellus *Cham.* (*Ypsolophus*). "Florida" (Dyar).

Larva on orange.

Known only from Florida.

Aproærema crotalariella *Busck.* Palm Beach, larvæ, adults issued Feb. 18–Mar. 10 (Dyar).

Larva on *Crotalaria pumila.*

[Known only from Florida.]

Anacampsis laguncalariella *Busck.* Lake Worth (Dyar); Everglade, Apr. 9 (A. M. N. H.).

Larva on *Laguncularia racemosa.*

Known only from Florida.

Anacampsis argyrothamniella *Busck.* Lake Worth (Dyar, Sloss.).

Larva on *Argyrothamnia blodgettii.*

Known only from Florida.

Gelechia coloradensis *Busck.* "Florida" (Dyar); La Belle, Apr. 27 (A. M. N. H.).

Extends to South Carolina and Colorado.

XYLORICTIDÆ.

Ide vestalis *Zell.* Lakeland, May 5, Fort Myers, Apr. 22 (A. M. N. H.).

Extends to South Carolina and Texas.

Ide lithosina *Zell.* "Florida" (Dyar).

Occurs in Texas.

ŒCOPHORIDÆ.

Cryptolechia obsoletella *Zell.* "Florida" (Sloss.).

Occurs in Ohio.

Depressaria amyrisella *Busck.* Palm Beach (Dyar).

Larva on *Amyris floridana.*

Known only from Florida.

Depressaria amissella *Busck.* Kissimmee (Beutenmüller).

Known only from Florida.

Ethmia confusella *Wlk.* Key West (Dyar).

Occurs in the Antilles.

BLASTOBASIDÆ.

Blastobasis guilandinæ *Busck.* Palm Beach, collected Mar. 5, bred Mar. 30 (Dyar).

Larva bores in stems of *Guilandina bonducella.*

Known only from Florida.

Blastobasis eriobotryæ *Busck.* [Miami (E. R. Sasscer).

Larva on loquat (*Eriobotrya japonica*) (Busck.).

Known only from Florida.]

ELASCHISTIDÆ.

Coleophora octagonella *Wlsm.* "Florida" (Dyar).

Known only from Florida.

Coleotechnistes citriella *Cham.* "Florida" (Dyar).

Known only from Florida.

Cosmopteryx floridanella *Beut.* "Central Florida" (Beutenmüller); Palm Beach, Jan. (Dyar).

Known only from Florida.

Cosmopteryx ipomœæ *Busck.* Lake Worth (Dyar).

Larva in leaves of *Ipomœa* sp.

Known only from Florida.

Cosmopteryx minutella *Beut.* "Central Florida" (Beutenmüller).

Known only from Florida.

Cosmopteryx attenuatella *Wlk.* Lake Worth (Dyar).

Occurs in the South Atlantic States.

Scelorthus pisoniella *Busck.* Palm Beach, bred in Feb. (Dyar).

Larva on *Pisonia obtusata* and *P. aculeata.*

Known only from Florida.

Scythris trivinctella *Zell.* Everglade, Apr. 7 (A. M. N. H.).

Occurs in Texas.

Antispila eugeniella *Busck.* Palm Beach, bred Feb. 25 (Dyar).

Larva in leaves of *Eugenia procera.*

Known only from Florida.

Cycloplasis panicifoliella *Clem.* Lake Worth (Dyar).

Larva on *Panicum divaricatum* and *P. clandestinum.*

Extends to New Jersey.

Coptodisca condaliæ *Busck.* Palm Beach, bred Feb. 12–24 (Dyar).

Larva in leaves of *Condalia ferrea.*

Known only from Florida.

Homaledra heptathalama *Busck.* Lake Worth (Dyar).

Larva on *Sabal palmetto.*

Known only from Florida.

Homaledra sabalella *Cham.* Lake Worth (Dyar).

Larva on *Sabal palmetto.*

Known only from Florida.

TINEIDÆ.

Stigmella condaliafoliella *Busck* (*Nepticula*). Palm Beach, bred Feb. 22 (Dyar).

Larva in leaves of *Condalia ferrea.*

Known only from Florida.

Stigmella myricafoliella *Busck.* (*Nepticula*). Lake Worth (Dyar)

Larva in leaves of *Myrica cerifera.*

Known only from Florida.

Bucculatrix ivella *Busck.* Lake Worth (Dyar).

Larva on *Iva frutescens.*

Cremastobombycia verbesinella *Busck.* (*Lithocolletes*). Lake Worth (Dyar).

Larva in leaves of *Verbesina virginica.*

Known only from Florida.

Bedellia minor *Busck.* Lake Worth (Dyar).

Larva in leaves of *Ipomœa* sp.

Known only from Florida.

Chilocampyla dyariella *Busck.* Palm Beach, bred Feb. 18–Mar. 20 (Dyar).

Larva in leaves of *Eugenia buxifolia* and *E. procera.*

Known only from Florida.

Lamprolophus lithella *Busck.* Palm Beach, bred in Feb. (Dyar).

Larva in stems of *Pisonia aculeata.*

Known only from Florida.

Eucosmophora sideroxyloniella *Busck.* Palm Beach, bred Feb. 27 (Dyar).

Larva in leaves of *Sideroxylon pallidum.*

Known only from Florida.

Gracilaria burserella *Busck.* Palm Beach, bred Feb. 21 (Dyar).

Larva on *Bursera gummifera.*

Known only from Florida.

Gracilaria sebastianella *Busck.* Lake Worth (Dyar).

Larva in leaves of *Sebastiana lucida.*

Known only from Florida.

Coriscium randiella *Busck.* Lake Worth (Dyar).

Larva in leaves of *Randia aculeata.*

Known only from Florida.

Marmara guilandinæ *Busck.* Palm Beach, bred Mar. 27 (Dyar).

Larva in stems of *Guilandina bonducella.*

Known only from Florida.

Leucoptera erythrinella *Busck.* Palm Beach, bred Feb. 10–20 (Dyar).

Larva in leaves of *Erythrina herbacea.*

Known only from Florida.

Leucoptera guettardella *Busck.* Lake Worth (Dyar).

Larva in leaves of *Guettardia elliptica.*

Known only from Florida.

Phyllocnistis intermediella *Busck.* Palm Beach, bred in early Feb. (Dyar).

Larva in leaves of *Sideroxylon pallidum.*

Known only from Florida.

Metriochroa psychotriatella *Busck.* Lake Worth (Dyar).

Larva on *Psychotria undata.*

Known only from Florida.

Podiasa chiococcella *Busck.* Lake Worth (Dyar).

Larva in leaves of *Chiococca racemosa.*

Known only from Florida.

Eucatagma amyrisella *Busck.* Palm Beach, Mar. (Dyar).

Larva on *Amyris floridana.*

Known only from Florida.

Xylestia pruniramiella *Clem.* Everglade, Apr. 7 (A. M. N. H.).

Larva in woody excrescences on plum trees.

Extends through the Atlantic States to New Jersey.

Tinea seminolella *Beut.* " Central Florida " (Beutenmüller).

Known only from Florida.

Prodoxus quinquepunctella *Cham.* Lakeland, May 6 (A. M. N. H.).

Larva on *Yucca filamentosa.*

Occurs in the South Atlantic States.

Pronuba yuccasella *Riley.* Lakeland, May 6, common (A. M. N. H., Ds.).

Larva on *Yucca filamentosa.*

Extends to New Jersey.

Acrolophus plumifrontellus *Clem.* La Belle, Apr. 26, 27, common (A. M. N. H., Ds.); Biscayne Bay (Sloss.).

Extends to New Jersey.

Acrolophus cervinus *Wlsm.* "Florida" (Beutenmüller).

Occurs in Georgia and Texas.

Acrolophus hulstellus *Beut.* Indian River, Kissimmee (Beutenmüller).

Known only from Florida.

Anaphora propinqua *Wlsm.* "Florida" (Dyar).

Known only from Florida.

Anaphora morrisoni *Wlsm.* "Florida" (Dyar).

Known only from Florida.

Anaphora tenuis *Wlsm.* Fort Myers, Apr. 23 (A. M. N. H.).

Extends to New Jersey.

Pseudanaphora arcanella *Clem.* Biscayne Bay (Sloss.).

Extends to New Jersey.

59.54,2(77)

Article II. — NEW ACARINA. PART II. — DESCRIPTIONS OF NEW SPECIES AND VARIETIES FROM IOWA, MISSOURI, ILLINOIS, INDIANA, AND OHIO.

By H. E. Ewing.

Plates I–IV.

This paper, Part II of my 'New Acarina,' has been written in accordance with the general plan of the series outlined in the preface to Part I.[1] Here are described, from five of our north central States, twenty-five new species and three new varieties. Some of these new species are rare, in fact a few of them are so rare that diligent search in the localities where they were discovered resulted in the capture of but a single individual. In other cases several or many specimens were secured. A few species here described are abundant in the localities where they were first found.

I have thought it advisable to erect a new genus, *Tegoribates*, for one of the rare beetle mites which was collected from the sand dune region around the southern end of Lake Michigan. It is quite peculiar among the members of its group in having the cephalothorax covered with a hood-like structure which projects forward from the anterior margin of the abdomen.

All of the forms described in Part II, have been collected from the upper austral life zone.

Genus **Bdella** *Latreille*.

Bdella tenuirostris, new species.

Plate I, Fig. 20.

A rather small species with short palpi. Alcoholic specimen yellowish. Cephalothorax cone-shaped. Beak fully as long, if not longer than cephalothorax proper. Palpi short, about three fourths as long as beak; second segment longer than the last three segments taken together; segment III and IV subequal in length, but III is much the broader of the two; last segment about equal in length to III plus IV, not broadened at its tip, and bearing distally the two long tactile bristles, which are of about equal length. Eyes subequal, contiguous. Post-rostral bristles of cephalo-

---

[1] New Acarina. Part I. General Considerations and Descriptions of New Species from Minnesota, Wisconsin, and Michigan. Bull. Amer. Mus. Nat. Hist., XXXII, pp. 93–121, pll. vii and viii. May 31, 1913.

thorax situated about two thirds their length from the base of the rostrum. Two pairs of posterior superior bristles of about equal length, the outer pair situated just next to the eyes. Abdomen broadly rounded behind, and clothed sparsely with moderate simple setæ. Legs large, posterior pair largest, and extending beyond the tip of the abdomen by the full length of the last two segments. Length including beak, 1.08 mm.; width, 0.38 mm.

From Xenia, Ohio; under a stone; by the writer.

This species is characterized by its very short palpi. Only a single specimen found, which I would be inclined to consider immature if it did not have the abdomen swollen with eggs.

Bdella peregrina *Banks,* var. **iowaensis**, new variety.

Similar to Banks's species but smaller. Body stouter than in *B. peregrina* of Banks. Length including the beak, 1.39 mm.; width, 0.71 mm.

From Ames, Iowa; under a stick, in the woods; by J. E. Guthrie.

Rare. It may be that this form should be considered a distinct species, yet I find that the palpal characters, which are very important in the genus *Bdella,* are the same as in Bank's *B. peregrina.*

Genus **Scirus** *Hermann.*

Scirus simplex, new species.

Plate I, Fig. 21.

A rather small pale species. Cephalothorax small. Beak long, slender toward distal end. Palpi large, strong, extending beyond the tip of the beak by one half the length of the distal segments. Segment I of palpus ring-like, small; segment II stout, about as long as broad, without hairs; segment III almost subequal to II; segment IV much smaller than III, slightly longer than broad, with a rather prominent hair on its inner aspect, and a small hair on its outer distal aspect; last segment slender and ending in a claw, about as long as III plus IV and with at least five hairs or setæ. The setæ of this last segment are distributed as follows: Two moderate setæ, arising from small tubercles on the inner surface, the posterior of which is the larger; one seta just below the distal claw; a very long tactile seta above distal claw, about one half as long as distal segment itself; a rather small seta about its length behind this long tactile seta. Hairs arising from pseudostigma-like pores on dorsal surface of cephalothorax, simple, very long and slender, about as long as length of cephalothorax. Abdomen clothed with a few small simple setæ. Legs almost subequal, the posterior pair slightly the largest, the anterior pair when extended reach the tips of the palpi. All the legs sparsely clothed with simple hairs. Length, including beak, 0.60 mm.; width, 0.22 mm.

From Urbana, Illinois; in refuse hog hair; by J. Zetek.

Described from one specimen, the type. This species is especially characterized by the absence of spines from the palpi.

Genus **Eupalus** *Koch.*

Eupalus parvus, new species.

Plate I, Fig. 22.

A very small pale species. Cephalothorax about as broad as long, chitinized around the base of the beak. Palpi slightly surpassing the beak; segment I very short, ring-like; segment II very long, stouter at each end than in the middle, with a prominent, simple, curved seta on the outer side; segment III claw-like, with two small hairs below near the base. Superior bristles of cephalothorax very long, simple, fully as long as the cephalothorax itself. Abdomen about two thirds as broad as long, broadest at the anterior margin, and with a few simple setæ. Legs rather short, posterior pair stoutest; anterior pair not surpassing the palpi, posterior pair extending slightly beyond the tip of abdomen. Legs with a few simple hairs. Length including beak, 0.33 mm.; width, 0.14 mm.

From Ames, Iowa; taken from oyster shell scale, *Lepidosaphes ulmi* Linn.; by T. M. McCall.

This is the species mentioned by R. L. Webster and the writer on page 130 of our joint paper: 'Mites Associated with the Oyster-shell Scale (*Lepidosaphes ulmi* Linne),' Psyche, Vol. XIX, pp. 121–134. It is a real enemy of the oyster shell scale, but is not very numerous here at Ames.

Genus **Raphygnathus** *Dugês.*

Raphygnathus pectinatus, new species.

Plate I, Fig. 23.

A tessellated species. Cephalothorax slightly smaller than abdomen. Palpi large, stout, over one half as long as first pair of legs; segment I ring-like; segment II very large, slightly swollen, about one and a half times as long as broad, with a rather prominent superior bristle; segment III short, outer margin much longer than inner; segment IV stout, curved, and ending in a strong claw; thumb cylindrical, reaching to tip of claw, with several rather long setæ. Abdomen not evenly rounded behind, broadest at anterior margin; like the cephalothorax tessellated. The abdomen bears above fourteen pectinate bristles. They are arranged as follows: A pair above near the anterior margin; a transverse row of four bristles about one third the distance from the anterior margin of the abdomen to its tip, a similar transverse row of four bristles at about two thirds the distance from the anterior margin of abdomen to its tip, and four terminal bristles. First and last pairs of legs subequal. Second and third pairs of legs subequal, but slightly smaller than others. Tarsal claws stout. Length, 0.30 mm.; width, 0.19 mm.

From Ames, Iowa; under an old piece of wood; by the writer.

This species is close to *R. tessellatus* Ewing, but differs from this latter species in that the setæ of the body are strongly pectinate instead of being simple or almost so. The anterior legs of *R. tessellatus* Ewing are much longer than the others, while in this species they are subequal with the last pair of legs.

Genus **Tenuipalpus** *Donnadieu.*

Tenuipalpus erythreus, new species.

Plate I, Fig. 24.

A small, stout, bright red species. Cephalothorax broad, about two thirds as large as abdomen. Rostrum and palpi small, the latter surpassing the former. Palpi composed of five segments; segment II much the largest; segment IV with a large tactile bristle above, longer than the segment itself; last segment of palpi almost as broad as long with a terminal spine-like digit as long as the segment itself and with two terminal setæ, both of which are longer than the terminal digit. A single pair of eyes present, situated sublaterally slightly behind the second pair of legs. Dorsally the cephalothorax bears three pairs of clavate, pectinated setæ; one pair near the anterior margin, one pair just in front of the eyes, and one pair behind the eyes not far from the posterior margin of cephalothorax. Abdomen quite broad, broadest over the posterior pair of legs, somewhat pointed behind, and bearing four clavate, pectinated setæ along its anterior margin above, and sixteen lateral and posterior marginal setæ of a characteristic semifoliaceous and semiscale-like shape (see Fig. 24). Legs short, stout, the two posterior pairs largely concealed from view when the mite is observed from above. Tarsal appendages each consisting of a pair of stout tarsal claws, from either side of which arises a long simple, knobbed tenent hair and an onychium proper situated between the tarsal claws and composed of four pectinate elements, the outer two of which are joined at their bases to the tarsal claws and all of which surpass the latter. Length, 0.35 mm.; width, 0.17 mm.

From Ames, Iowa; shaken from branch of cedar; by the writer. From several points in Oregon; on arbor vitæ; by the writer.

Described from many specimens which I have labeled cotypes.

Genus **Erythræus** *Latreille*.

The two new species of *Erythræus* here described may be separated by the following key:

I 1. Posterior pair of legs over three times as long as the body — *E. phalangiolus* n. sp.

I 2. Posterior pair of legs about one and a half times as long as body — *E. quadratus* n. sp.

Erythræus phalangiolus, new species.

Plate I, Fig. 25.

A very long-legged phalangid-like species, being peculiar to all our mites in this respect. Dorsal groove, or crista, extending from about the middle of the body almost to the base of the rostrum, bearing at its posterior end two small simple hairs and at its anterior swollen end at least four rather large, slightly clavate setæ. Palpi fully twice as long as rostrum, and well clothed with simple and slightly curved setæ; next to last segment ending in a large, long claw; thumb cylindrical, not reaching the tip of claw and well clothed with curved and slightly pectinated setæ. Abdomen not distinct from cephalothorax and both clothed with clavate setæ which are also somewhat flattened and feathered. Legs very long; anterior pair about twice as long as body; posterior pair over three times as long as body. Tarsi of anterior legs slightly swollen, much shorter than tibiæ. Tarsi of posterior legs not swollen, less than one half as long as the very long tibiæ. Legs are sparsely clothed with bristles, those on the proximal segments bent near their bases so that they lie close to the surface on which they are situated. Length, 1.68 mm.; width, 1.35 mm.

From Xenia, Ohio; under bark of elm; by the writer.

I collected only a single specimen of this interesting species. Several others were observed, but I mistook them for immature phalangids. I was much surprised, upon later examination, to find that this one specimen was a mite. It was collected Sept. 14, 1910.

Erythræus quadratus, new species.

Plate I, Fig. 26.

No division between cephalothorax and abdomen. Posterior bristles of crista simple, about two thirds as long as the crista itself. Bristles on anterior tubercle of crista about fourteen in number, about as long as the posterior bristles but stouter and pectinate. Palpi about as long as crista; femur of palpus about one half as long as the entire palpus; antepenultimate segment of palpus about one half as long as femur; thumb of palpus not swollen, equal to the claw, with several simple bristles. Anterior and posterior eyes equal, about their diameters apart. Abdomen almost truncate posteriorly, well clothed with curved pectinate hairs. Anterior and posterior pairs of legs subequal. Second and third pairs of legs subequal, but shorter than the other two pairs. Tarsi of anterior legs but slightly swollen, not as long as the tibiæ. Tarsi of posterior legs slightly swollen, about one half as long as tibiæ. Hairs on legs of two kinds, most of them are rather short and curved, a few, however, are considerably longer, stiff, almost straight, and stick out at about right angles to the axes of the segments. Length, 1.30 mm.; width, 0.62 mm.

From Marshall, Illinois; on smart-weed; by the writer.

Related to *E. pilosus* Banks, but differs from this species in having much longer legs and in the shape of the body.

Genus **Atomus** *Latreille.*

The two species of this genus here described are separated in the following key:

I 1. Body black; anterior pair of legs almost one and a half times as long as the body — *A. niger* n. sp.
I 2. Body reddish; anterior pair of legs but little longer than the body — *A. longilinea* n. sp.

Atomus niger, new species.

Plate II, Fig. 27.

Body black; legs reddish brown. Anterior tubercle of crista with about a dozen almost straight, stout, simple, or very slightly pectinate, bristles. Palpi about twice as long as beak; antepenultimate segment about three fourths as long as femur; penultimate segment weaker than usual; thumb not swollen, reaching the tip of palpal claw and with several simple setæ. Abdomen as well as cephalothorax clothed with curved pectinate bristles. These bristles are pectinate only on one side, where there are present from two to several rather long prongs. Anterior pair of legs longer than the body, their tarsi swollen and about three fourths as long as tibiæ. Posterior legs extending beyond the tip of the abdomen, by fully one half their length, their tarsi swollen, quite short, being not more than one half as long as the tibiæ. All the legs are clothed with two kinds of setæ, the shorter curved ones, and the longer, stiff, almost straight type which extend almost at right angles to the surface of the segments. Length, 1.17 mm.; width, 0.83 mm.

From Havana, Illinois; on grape vine; by C. A. Hart and the writer.

Related to *E. pilosus* Banks, but has a black body which is clothed with a different type of setæ. Two specimens procured.

Atomus longilinea, new species.

Plate II, Figs. 28–29.

A stout species with rather short legs. Crista very long, extending back almost to the third pair of legs. It is strongly swollen at its posterior end and at about one fourth its length from the anterior end. Posterior bristles of crista very small, and simple, anterior bristles, two in number and similar to posterior bristles. Beak rather short, conical. Palpi slightly surpassing the beak; thumb slightly swollen and slightly surpassing the claw. Eyes situated considerably behind the anterior swollen region of the crista, and also behind the second pair of legs. Body well clothed with hairs, which with low power lenses appear to be scale-like, but with higher powers are found to be short and strongly pectinate. Anterior pair of legs slightly longer than the body; tarsi swollen, about three fourths as long as tibiæ. Posterior pair of legs about equal to anterior pair of legs; tarsi swollen, slightly over one half as long as tibiæ. Legs clothed with but a single kind of bristle which are like those on the body only they are much longer and more pointed. Length, 2.40 mm.; width, 1.75 mm.

From Xenia, Ohio; under bark of apple; by the writer.

This species resembles somewhat the species of *Fessonia* in the nature of the body bristles and in having such a long crista. It is quite different from our other species of *Atomus*.

Genus **Eutrombidium** *Verdun.*

Eutrombidium corticis, new species.

Plate II, Fig. 30.

A medium-sized, bright red species. Palpi stout; femur swollen, somewhat pedicellate at its base; antepenultimate segment about three fifths as long as femur, swollen and curved; penultimate segment including claws, slightly longer than antepenultimate segment; inner claw about one half as long as outer claw; thumb slightly swollen, well clothed with moderate, curved, pectinate bristles, and surpassing the largest palpal claw. Swollen area of crista with two kinds of long setæ; a single pair of simple, slender setæ situated on the chitinous disc, and several much stouter pectinate setæ outside of disc. Body well clothed with curved, pectinate setæ. Anterior legs somewhat longer than body; tarsi but very slightly swollen, about three fourths as long as tibiæ. Posterior legs about equal to the anterior legs in length; tarsi not swollen, and almost as long as the tibiæ. Legs clothed with but a single kind of hair, although some hairs are longer than others and doubtless are tactile. Length, 1.28 mm.; width, 0.8 mm.

From Ames, Iowa; under bark; by the writer.

Rare. Description from a single specimen. Quite different from *E. locustarium* (Walsh) and *E. magnum* (Ewing), in the shape of the body, size, etc.

Genus **Enemothrombium** *Berlese.*

Two new species described. They are separated as follows:

I 1. Body clothed with pectinate setæ of the usual type; abdomen broadest behind the shoulder region, and with three prominent transverse dorsal grooves — *E. ovalis* n. sp.

I 2. Body clothed with short, strongly and irregularly clavate, pectinate setæ; abdomen broadest at the shoulder region, and without transverse dorsal grooves — *E. penicillifer* n. sp.

Enemothrombium ovalis, new species.

Plate II, Figs. 31, 32.

Red, unicolor. Cephalothorax about as broad as long, conical. Dorsal groove extending for almost the entire length of the cephalothorax; posterior bristles of crista slender, simple, about two thirds as long as the groove itself. Palpi large, stout; femora of palpi much swollen and strongly arched; penultimate segments with long, strong, sharp claws, the inner of which is about two thirds as long as the outer; thumb slightly swollen, extending to tip of outer claw, and well clothed with hairs. Abdomen oval, broadest at the insertion of the third pair of legs, dorsally with three transverse grooves, the anterior of which is the longest. Abdomen well clothed with pectinate setæ. Anterior pair of legs about as long as the body; tarsi slightly swollen and a little longer than tibiæ. Posterior legs subequal to anterior legs; tarsi not swollen, subequal to tibiæ. Length, 1.62 mm.; width, 1.25 mm.

From Ames, Iowa; running over the ground; by the writer.

This and the following species are the first of the genus *Enemothrombium* I have found in this country. It may possibly be that some of our previously described species go into this genus, but Berlese in his monograph of the family does not place any of our described species in it.

Enemothrombium penicillifer, new species.

Plate II, Fig. 33.

A small pale species. Body long, broadest at the shoulder region. Cephalothorax conical. Crista about one half as long as cephalothorax; its posterior hairs almost as long as the crista itself. Palpi stout, about one half as long as the anterior pair of legs; femora swollen, and arched; penultimate segment with outer claw very strong, inner claw about two thirds as long as outer; thumb of palpus slightly swollen and extending to tip of outer palpal claw. Body sparsely clothed with peculiar setæ. These setæ are short, very strongly and irregularly clavate and minutely pectinate. Legs short; anterior pair about three fifths as long as body, tarsi of anterior pair strongly swollen and about one and a half times as long as the tibiæ. Posterior pair of legs extending slightly beyond the tip of the abdomen; their tarsi not swollen and somewhat longer than the tibiæ. Legs clothed with curved, singly pectinate setæ. Length, 1.02 mm.; width, 0.57 mm.

From Marshall, Illinois; under a stone; by the writer.

This species is entirely different from *E. ovalis.* It is much smaller, different in color, shape, length of the legs, and in the kind of hairs on the body. Described from a single specimen, the type.

Genus **Allothrombium** *Berlese.*

Allothrombium pulvinus, new species.

Plate II, Figs. 34, 35.

A large species with a dark body and reddish legs. Cephalothorax very small in comparison with the abdomen. Palpi rather slender, as long as the first four segments of the anterior pair of legs; femora long, somewhat swollen, and pedicellate at base; thumb of palpus swollen, well clothed with hairs, and surpassing the palpal claw. Posterior eyes smaller than anterior ones and both situated on long pedicels. Abdomen broadest in front of third pair of legs, evenly rounded behind, and well clothed with strongly pectinate hairs. Anterior pair of legs about as long as the body; tarsi but slightly, if at all, swollen, equal to the tibiæ in length. Posterior pair of legs somewhat shorter than the anterior pair; tarsi not swollen and about equal to the tibiæ. The tarsus of each leg is provided with two strong claws and a pulvillus composed of two equal elements; these are brush-like and extend to the tip of the tarsal claws. Length, 3.30 mm.; width, 2.50 mm.

From Marshall, Illinois; under an old log; by the writer.

Described from two specimens. This is the only species of *Allothrombium* I have in my collection. Berlese in his monograph mentions no species of this genus from North America.

Genus **Trachyuropoda.**

Trachyuropoda longa, new species.

Plate III, Fig. 36.

Reddish brown, or chestnut, color. Body about twice as long as broad, granular above, and irregularly tuberculate around the margins. Mouth-parts small. Genital opening of male circular, situated directly between the coxæ of the third pair of legs and at the middle of the sternum. Anus small, not circular, situated about its longest diameter from posterior margin of abdomen. Legs rather short, and when somewhat flexed hidden from above; first pair when extended reaching the tip of the hood-like projection at the anterior end of the body, tarsus with inner margin almost straight and hairless except for two hairs near the tarsal claws, outer margin curved, strongly chitinized and with several hairs; claws of tarsus I rather weak and situated on a tarsal pedicel which is about as long as the greatest width of the tarsus itself; last pair of legs when extended not reaching the tip of the abdomen. Length, 0.75 mm.; width, 0.47 mm.

From Xenia, Ohio; under stones; by the writer.

Rare, only a single specimen secured. I have never found this species in either Illinois or Iowa, where I have done extensive collecting for many years.

Genus **Tegoribates,** new genus.

Lamellæ and translamella absent. Pseudostigmatic organ not foliaceous or rod-like. Tectopedia I and II absent. Abdomen about as broad as long but not spherical. Pteromorphæ wing-like, truncate in front, and not extending beyond the anterior margin of abdomen. Abdomen hairless. Legs moderate, not moniliform; femora II without prominent cusps; ungues tridactyle.

Type *T. subniger*, new species.

This genus is created to include a new form I have found which differs from all the other *Pterogasterea* in the possession of a hood-like covering over the cephalothorax. It is without lamellae and translamella, but instead has the cephalothorax covered above by this hood-like, or roof-like, structure which projects forward from the anterior margin of the abdomen, and extends beyond the tip of the rostrum.

Tegoribates subniger, new species.

Plate III, Fig. 37.

A dark, almost black species. Cephalothorax about one third as long as abdomen. Lamellæ, translamella, lamellar hairs and interlamellar hairs absent. Hood, or roof, of cephalothorax, about as broad as long, extending from one pseudostigma to the other laterally, and forward to beyond the rostrum. When viewed from the side this hood is seen to be distinct from the dorsal integument of the cephalothorax and may in fact be lifted up above the latter. Pseudostigmatic organs clavate, simple, and pointed at their tips. Abdomen about as broad as long, hairless above; pteromorphæ when viewed from the side, seem to be evenly rounded along their ventral margins, without cusps or emarginations. Legs rather small; anterior pair extending beyond the tip of the rostrum, but posterior pair not reaching the tip of the abdomen. Length, 0.58 mm.; height, 0.35 mm.

From Pine, Indiana; under old waste lumber; by the writer.

This species, the type of a new genus, is described from a single perfect specimen (a female) which I have had in my collection since 1907. It was collected from the sand dune region about the southern end of Lake Michigan. I have hoped to find other specimens of it, but in vain.

Genus **Trachyoribates** *Berlese.*

Trachyoribates zeteki, new species.

Plate III, Fig. 38.

Shiny, light brown. Cephalothorax separated from abdomen by a transverse ridge. Lamellæ prominent, two thirds as long as cephalothorax, with rather prominent cusps. Translamella a mere ridge or line. Interlamellar hairs, long, almost straight, pectinate, about as long as the lamellæ themselves and situated just in front of the anterior margin of abdomen. Lamellar hairs similar to the interlamellar hairs but shorter, each springs from the tip of a lamellar cusp. Outside of the true lamellæ is situated a pair of lateral lamellæ that is more spine-like than blade-like. These lateral lamellæ are curved, and extend forward almost to the tip of the rostrum. Pseudostigmatic organs strongly clavate, simple, directed forward and about one half as long as the lamellæ. Abdomen as broad as long, hairless above. Pteromorphæ large, rounded ventrally, not emarginate. Genital covers about two thirds as large as anal covers, and situated almost twice their length in front of the latter. Legs moderate; anterior pair extending beyond the tip of the rostrum by fully one half their length, tibiæ of anterior pair of legs each with a large tubercle on its dorsal distal aspect from which extends a long, simple, tactile bristle as long as the tibia itself. Claws of tarsi unequal. Length, 0.39 mm.; width, 0.31 mm.

From Urbana, Illinois; in refuse hog hair; by J. Zetek.

Rather closely related to *T. enodis* (Ewing), but differing from this species in the shape of the true and the lateral lamellæ. Described from two specimens.

Genus **Peloribates** *Berlese.*

Peloribates iowaensis, new species.

Plate III, Fig. 39.

A subspherical, shiny species. Cephalothorax separated from abdomen by a line. Lamellæ about two thirds as long as cephalothorax, broadest at their bases and gradually tapering to their anterior ends; without cusps. Translamella represented by a line. Interlamellar hairs, large, erect, pectinate, about as long as the lamellæ, and situated very near the posterior margin of cephalothorax. Lamellar hairs similar to interlamellar hairs, but slightly shorter; they extend, however, beyond the tip of the rostrum by about one half their length. Pseudostigmatic organs, clavo-lanceolate, recurved, and pectinate toward their tips. Abdomen subspherical, and provided above with about two dozen, large, curved, doubly pectinate bristles. Pteromorphæ large, somewhat pointed ventrally, not emarginate. Genital covers not more than two thirds as long as anal covers, situated about two times their length in front of the latter. Anal covers situated almost approximate to the posterior margin of ventral plate. Legs moderate; anterior pair extending beyond the tip of the rostrum by about one half the length of their tarsi. Tarsi of anterior pair of legs longer than the tibiæ. Claws of all tarsi unequal. Length, 0.50 mm.; width, 0.36 mm.

From Ames, Iowa; under an old piece of wood; by the writer.

Related to my *P. serratoseta*, but differing from it in having the abdomen much more spherical, in having the pseudostigmatic organs clavo-lanceolate, instead of strongly clavate, as well as in other respects.

Genus **Oribatella** *Banks.*

Oribatella achipteroides *Ewing,* var. **australis**, new variety.

Plate III, Figs. 40, 41.

Smaller and of a lighter color than the type of the species. In the type each lamella is produced in front into a lateral cusp. Not so in this more southern form from Iowa. In this southern form the lamellar hairs are shorter and more curved, than in the type. The pseudostigmatic organs are more slender than in the type of the species. Length, 0.47 mm.; width, 0.31 mm.

From Ames, Iowa; under a stone; by the writer.

The type of this species was collected by Professor J. E. Guthrie, from Red Wing, Minnesota. It was taken either under bark or from chips on lowland. It is quite possible that this form from Iowa should be regarded as a new species on account of several of its structural peculiarities, but at present we do not know enough about the habits of the two forms or whether or not intergrades exist.

Genus **Oribata** *Latreille.*

Oribata quadrisetosa, new species.

Plate III, Fig. 42.

A large, black, shiny species. Cephalothorax separated from abdomen by a transverse curved line. Superior hairs of cephalothorax very long, almost straight, and pectinate; lateral hairs, curved, pectinate and extending about one half their length beyond the tip of the rostrum. There is a much smaller, but similar pair of accessory lateral hairs, below the larger ones. Abdomen about three fourths as broad as long, evenly rounded behind, and without hairs except for four very prominent ones at the posterior margin. These are subequal and are about one half as long as the width of the abdomen. Pteromorphæ large, reaching to the tip of the rostrum, rounded anteriorly and ventrally but not broadly rounded in either case. Genital covers about three fourths as long as anal covers, and situated about one and one half times their length in front of the latter. Anterior pair of legs extending about one half their length in front of the tip of the rostrum; tarsi and tibiæ subequal, the latter each with an anterior dorsal seta-bearing tubercle. Claws of all the tarsi about equal. Length, 0.88 mm.; width, 0.63 mm.

From Xenia, Ohio; under a log; by the writer. From Muncie, Illinois; under bark; by the writer.

Closely related to *O. robusta* Banks, but has the pteromorphæ rounded, not pointed in front, also it has the four big bristles on the posterior margin of the abdomen.

Genus **Liacarus** *Michael.*

Liacarus fusiformis, new species.

Plate III, Fig. 43.

A rather small, light colored species. Two pairs of lamellæ present; inner pair, blade-like, somewhat broader toward the middle than at the ends, coming together and fusing anteriorly, but each also produced into a cusp; outer lamellæ somewhat blade-like, but very narrow and on edge, they extend for the entire length of the cephalothorax. Interlamellar hairs very long, longer than the lamellæ, and slightly pectinate. Lamellar hairs arising from tips of lamellar cusps; long, straight, slightly pectinate, and extending for one half their length beyond the tip of the rostrum. Near the tip of the rostrum is a pair of hairs similar to the lamellar hairs, but smaller and curved somewhat. Pseudostigmatic organs slightly bent outward, fusiform, and slightly pectinate at their tips. Abdomen hairless above. Genital opening circular, about its diameter in front of the anal opening; anal opening much larger than genital opening. Legs moderate; anterior pair extending fully one half their length beyond the tip of the rostrum; tibia I and tarsus I subequal, tibia I without anterior tubercle, but with a long tactile hair which extends much beyond the tip of tarsus. Claws of tarsi unequal. Length, 0.63 mm.; width, 0.41 mm.

From Ames, Iowa; under an old piece of wood; by the writer.

This species is near *L. magnilamellatus* Ewing, but differs from it in having the fusiform pseudostigmatic organs instead of clavo-lanceolate ones with very long pedicels.

Genus **Cultroribula** *Berlese.*

Cultroribula confinis *Berlese,* var. **magna**, new variety.

Plate III, Fig. 44.

In this variety the pseudostigmatic organs are much shorter than they are in Berlese's form. Prominent interlamellar hairs are present, and the variety is also larger than the type of the species. Length, 0.66 mm.; width, 0.52 mm.

From Urbana, Illinois; under bark of hackberry; by the writer.

Described from two specimens, one of which had a harvest mite larva attached to it.

Genus **Oribatula** *Berlese.*

Oribatula clavata, new species.

Plate IV, Fig. 45.

Light brown, shiny. Cephalothorax large, broadest between first and second pair of legs. Lamellæ slightly over one half as long as the cephalothorax, of equal width throughout, and joined together anteriorly by the translamella which is of equal breadth with the lamellæ. Superior bristles long, divergent, slightly curved, and pectinate. Lamellar hairs subequal to superior bristles, and extending slightly beyond the tip of the rostrum. Pseudostigmatic organs clavate, simple, recurved, about three fifths as long as the lamellæ. Abdomen almost twice as long as broad, shoulder regions with a much thickened layer of chitin. Above, the abdomen has four small, oval, light spots which may be sense areas; two of these are situated far forward near the shoulders, and two a little behind the middle of the abdomen. Above, the abdomen bears about two dozen small, curved, simple bristles. Both genital and anal openings large, almost circular, the former situated about one and one half times its length in front of the latter. Legs moderate; anterior pair extending one half its length beyond the tip of the rostrum; posterior pair not reaching the tip of the abdomen. Tarsi and tibiæ of anterior legs subequal, the latter with the large distal tubercles from which extend the tactile hairs, the latter being longer than the tarsi. Claws of tarsi unequal. Length, 0.42 mm.; width, 0.29 mm.

From Arcola, Illinois; under an old board; by the writer.

A specimen of this species was sent to Banks, and he wrote that it was new.

Genus **Tegeocranus** *Nicolet.*

Tegeocranus subniger, new species.

Plate IV, Fig. 46.

Dark brown, almost black. Cephalothorax separated from abdomen by a transverse, almost straight line. Lamellæ very large, extending beyond the tip of rostrum, broadest not far from their base. No interlamellar hairs. Pseudostigmatic organs, clavate, recurved and with pectinate heads. Abdomen broader than long, evenly and broadly rounded behind, and with a few minute hairs dorsally. Shoulder expansions large, with undulating margins, reticulate, and extending forward beyond the anterior margin of the abdomen. Genital covers, subrectangular, situated about two thirds their length from the larger, subrectangular anal covers. Legs large; anterior pair extending beyond the tip of the rostrum by about the full length of their tarsi; tibiæ of anterior legs without anterior tubercles; posterior pair of legs extending beyond the tip of the abdomen by about one half the length of their tarsi. Tarsi of legs each with a single, stout, curved claw. Length, 0.72 mm.; width, 0.57 mm.

From Ames, Iowa; under old pieces of wood on the ground; by the writer.

This species is fairly abundant here at Ames under old pieces of wood. It is in fact one of our most common large beetle mites. I have used it for internal anatomy studies, and find it excellently adapted for such purposes.

Genus **Damæus** *C. L. Koch.*

The two species of this genus here recorded and described are separated as follows:

I 1. Cephalothorax moderate, without superior bristles; abdomen somewhat pointed behind; tarsi and tibiæ both swollen and pedicellate — *D. minutus* n. sp.

I 2. Cephalothorax large, with two pairs of superior bristles; abdomen broadly rounded behind; tarsi very short and strongly swollen at their bases; tibiæ but little, if at all, swollen — *D. brevitarsus* n. sp.

Damæus minutus, new species.

Plate IV, Fig. 47.

Minute; light yellowish brown, shiny. Cephalothorax large, broadest just in front of the pseudostigmatic organs, slightly sculptured above near the posterior margin. Cephalothorax hairless, except for the small, very strongly curved, singly pectinate rostral hairs near the tip of the rostrum. Pseudostigmatic organs large, clavo-lanceolate, pectinate, almost straight, and about as long as femora II. Abdomen about two thirds as broad as long, pointed at the tip, with about twenty, small, simple, curved bristles above. Genital covers, rectangular, each about twice as long as broad, situated about twice their length from the larger but more circular anal covers. Legs prominent, but short for the genus; anterior pair extending beyond the tip of the rostrum by over one half their length, tarsi longer than tibiæ, tibiæ each with a long tactile hair at its tip above, which extends beyond the tip of the tarsi. Coxæ of third pair of legs subspherical in shape, each with a small tubercle on its anterior aspect and a single strongly curved, singly pectinate bristle. Posterior legs extending beyond the tip of the abdomen by the full length of their tarsi. Most of the segments of the legs are moderately swollen toward one end, and pedicellate at the other end. Length, 0.28 mm.; width, 0.14 mm.

From Illinois; situation not known; collector not known.

I have but a single specimen of this very minute and rare species. It is well preserved.

Damæus brevitarsus, new species.

Plate IV, Fig. 48.

Body long, and legs short for the genus. Cephalothorax very large, two thirds as long as the abdomen, with two superior sculptured ridges in front of the pseudostigmata. These ridges are about one third as long as the cephalothorax and curved inward. Tectopedia present for first pair of legs, and between legs II and III is located a large tubercle on each side of the cephalothorax. Superior bristles short, pectinate, situated slightly in front of the pseudostigmata. In front of the chitinous ridges is situated a large pair, of simple straight bristles which extend beyond the tip of the rostrum. Pseudostigmatic organs very long, clavate, pectinate, somewhat longer than the femora of legs II. Abdomen longer than broad, truncate anteriorly and evenly rounded posteriorly, the shoulder regions very strongly chitinized. Above the abdomen bears about fourteen, simple, curved bristles. Genital covers subrectangular and situated their length in front of the larger, similar anal covers. Legs short for the genus, with short, globose tarsi; femora swollen but not globose though pedicellate at their bases. Anterior pair of legs extending beyond the tip of the rostrum by about two thirds their length; tarsi slightly shorter than the tibiæ; tibiæ each with distal tubercle and long tactile hair which extends beyond the tip of the tarsus. Tarsi of posterior legs strongly globose scarcely two thirds as long as the tibiæ; tibiæ not globose, bearing each a very long tactile hair distally which extends beyond the tips of the tarsi. Ungues of all tarsi unequal. Length, 0.58 mm.; width, 0.30 mm.

From Ames, Iowa; under an old piece of wood; by myself.

This species is especially noted for its large cephalothorax and for the short globular tarsi. Only a single specimen found.

Genus **Phthiracarus** *Perty.*

Phthiracarus pectinatus, new species.

Plate IV, Fig. 49.

Yellowish brown. Cephalothorax slightly over one half as long as abdomen, and about twice as long as high; above, it is provided with three pairs of prominent, almost straight, pectinate bristles, the posterior pair of which is the longest and the anterior pair the shortest. Pseudostigmatic organ with a rather long pedicel and an expanded head with a concave posterior margin and a convex anterior margin, simple behind but strongly pectinate in front. Abdomen almost as high as long; anterior margin emarginate where the cephalothorax is attached; behind the abdomen is somewhat pointed. Above, the abdomen bears several, curved, pectinate bristles; a longitudinal row of five bristles on each side near the median plane, below this row another row of five similar, but somewhat smaller bristles, and below this row three bristles. Genital covers about three fourths as long as anal covers. Legs stout; anterior pair extending somewhat beyond the tip of cephalothorax. Claws of all tarsi heterodactyle. Length, 0.76 mm.; height, 0.45 mm.

From Mahomet, Illinois; data on situation lost; by the writer.

Related to *P. americanus* Ewing and to *P. fulvus* Ewing, but differing from both of these species in having pectinate pseudostigmatic organs and a few other minor characters.

Genus **Pigmeophorus** *Kramer.*

Pigmeophorus quadratus, new species.

Plate IV, Fig. 50.

Female.— Pale, flesh colored. Cephalothorax about one half as long as abdomen. Capitulum pouch-shaped, somewhat broader than femur of leg I. Sensory organs capitate, about one half as broad as femur I. Abdomen quadrate, with a very long pair of simple, almost straight shoulder bristles. These shoulder bristles are about two thirds as long as the width of the abdomen at its anterior margin. At its posterior margin the abdomen bears two pairs of prominent, simple setæ. They are about equal to one half the width of the abdomen at its posterior margin. Legs short and stout; anterior pair about as long as the cephalothorax; femur I equal to tibia I, its lateral margin being almost twice as long as its inner margin; tibia I as long as broad, and about three fifths as long as tarsus I. Posterior legs not extending beyond the tip of the abdomen; tarsus IV slender, tapering, about twice as long as tibia. Length, 0.26 mm.; width, 0.15 mm.

From Illinois; on mushroom; by Mr. Duncan.

Differs from *P. americanus* Banks in having shorter legs, and only two pairs of bristles on the posterior margin. These are quite long.

EXPLANATION OF PLATES.[1]

Plate I.

Fig. 20. *Bdella tenuirostris* n. sp. Dorsal view, × 38.

Fig. 21. *Scirus simplex* n. sp. Right palpus from inside, × 240.

Fig. 22. *Eupalus parvus* n. sp. Right palpus from above, × 240.

Fig. 23. *Raphygnathus pectinatus* n. sp. Seta from tip of abdomen, × 720.

Fig. 24. *Tenuipalpus erythreus* n. sp. Seta from body, × 720 (?).

Fig. 25. *Erythræus phalangiolus* n. sp. Dorsal view, × 10.

Fig. 26. *Erythræus quadratus* n. sp. Dorsal view, × 14.

Plate II.

Fig. 27. *Atomus niger* n. sp. Tip of palpus from above, × 240.

Fig. 28. *Atomus longilinea* n. sp. Dorsal groove, or crista, × 72.

Fig. 29. *Atomus longilinea* n. sp. Seta from body, × 320.

Fig. 30. *Eutrombidium corticis* n. sp. Dorsal view, × 14.

Fig. 31. *Enemothrombium ovalis* n. sp. Dorsal view, × 12.

Fig. 32. *Enemothrombium ovalis* n. sp. Seta from body, × 720.

Fig. 33. *Enemothrombium penicillifer* n. sp. Dorsal view, × 38.

Fig. 34. *Allothrombium pulvinus* n. sp. Distal part of tarsus from above, × 72.

Fig. 35. *Allothrombium pulvinus* n. sp. Seta from body, × 320.

Plate III.

Fig. 36. *Trachyuropoda longa* n. sp. Tarsus of leg I, × 240.

Fig. 37. *Tegoribates subniger* n. sp. Dorsal view, × 72.

Fig. 38. *Trachyoribates zeteki* n. sp. Lamellæ, translamella and lamellar hairs, × 240.

Fig. 39. *Peloribates iowaensis* n. sp. Dorsal view, × 72.

Fig. 40. *Oribatella achipteroides* Ewing, var. *australis* n. var. Right lamella and lamellar hair from above, × 320.

Fig. 41. *Oribatella achipteroides* Ewing, var. *australis* n. var. Right pseudostigmatic organ from above, × 320.

Fig. 42. *Oribata quadrisetosa* n. sp. Dorsal aspect of posterior part of abdomen, × 72.

Fig. 43. *Liacarus fusiformis* n. sp. Right pseudostigmatic organ from above, × 320.

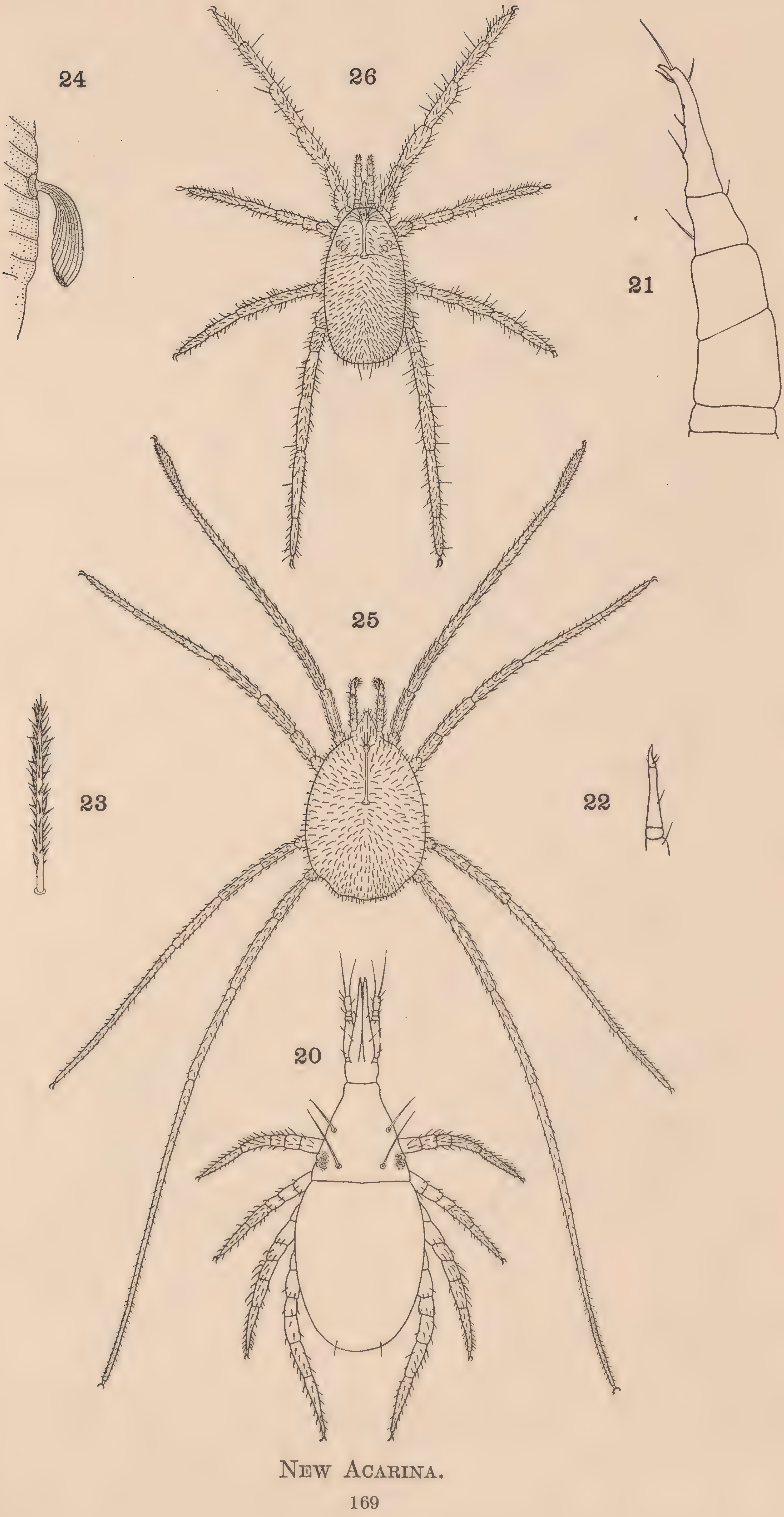
Fig. 44. *Cultroribula confinis* Berlese, var. *magna* n. var. Dorsal view, × 72.

---

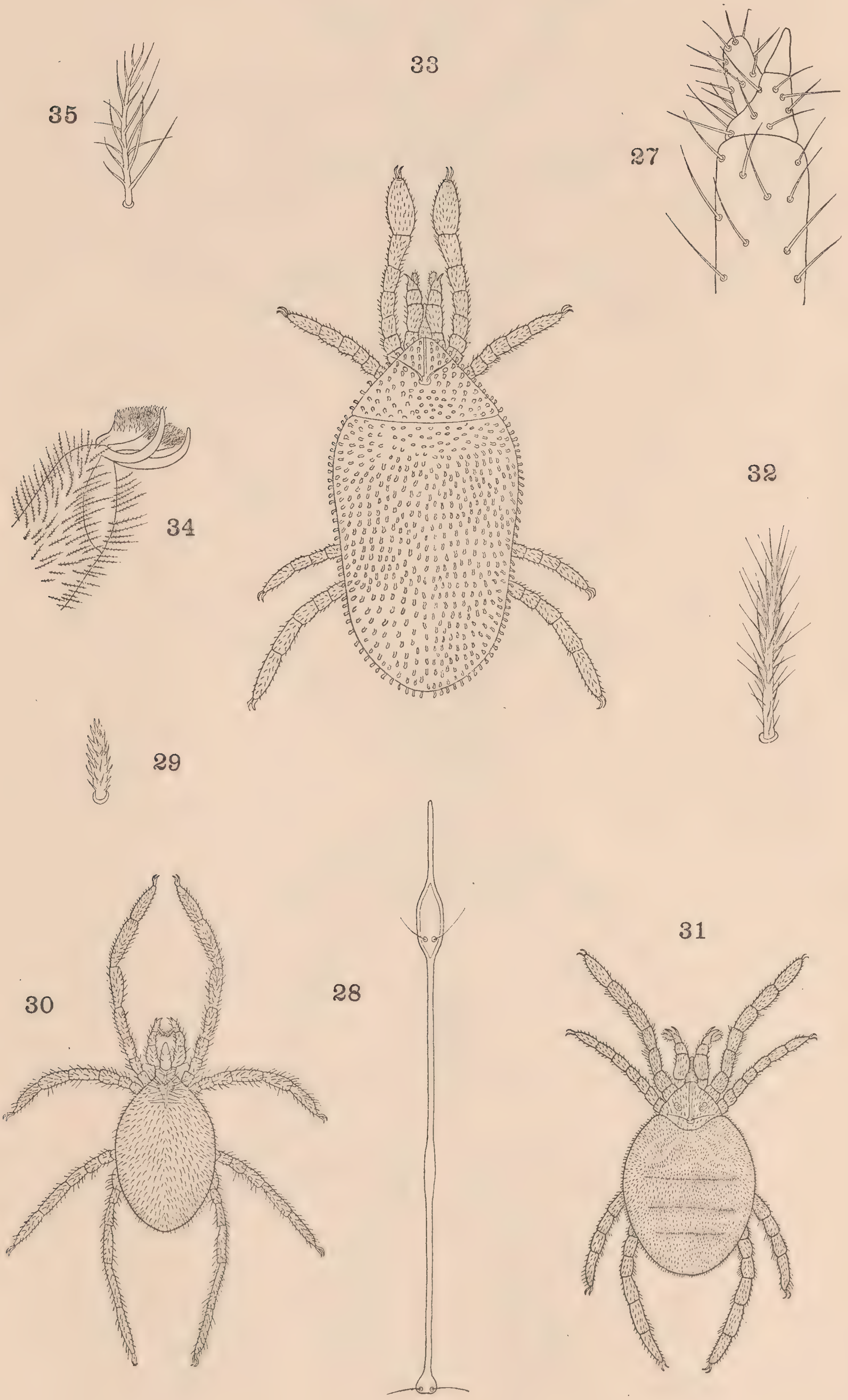
[1] All of the drawings given in this paper have been reduced to two fifths their original linear dimensions. Some of the characters represented in them, therefore, would not be distinguished at the magnifications indicated in this explanation of the plates.

PLATE IV.

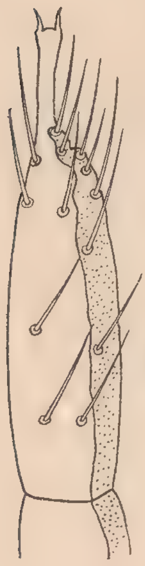
Fig. 45. *Oribatula clavata* n. sp. Dorsal view, × 72.
Fig. 46. *Tegeocranus subniger* n. sp. Dorsal view, × 48.
Fig. 47. *Damæus minutus* n. sp. Dorsal view, × 100.
Fig. 48. *Damæus brevitarsus* n. sp. Dorsal view, × 72.
Fig. 49. *Phthiracarus pectinatus* n. sp. Right pseudostigmatic organ as seen from the outside, × 320.
Fig. 50. *Pigmeophorus quadratus* n. sp. Right anterior leg from above, × 240.

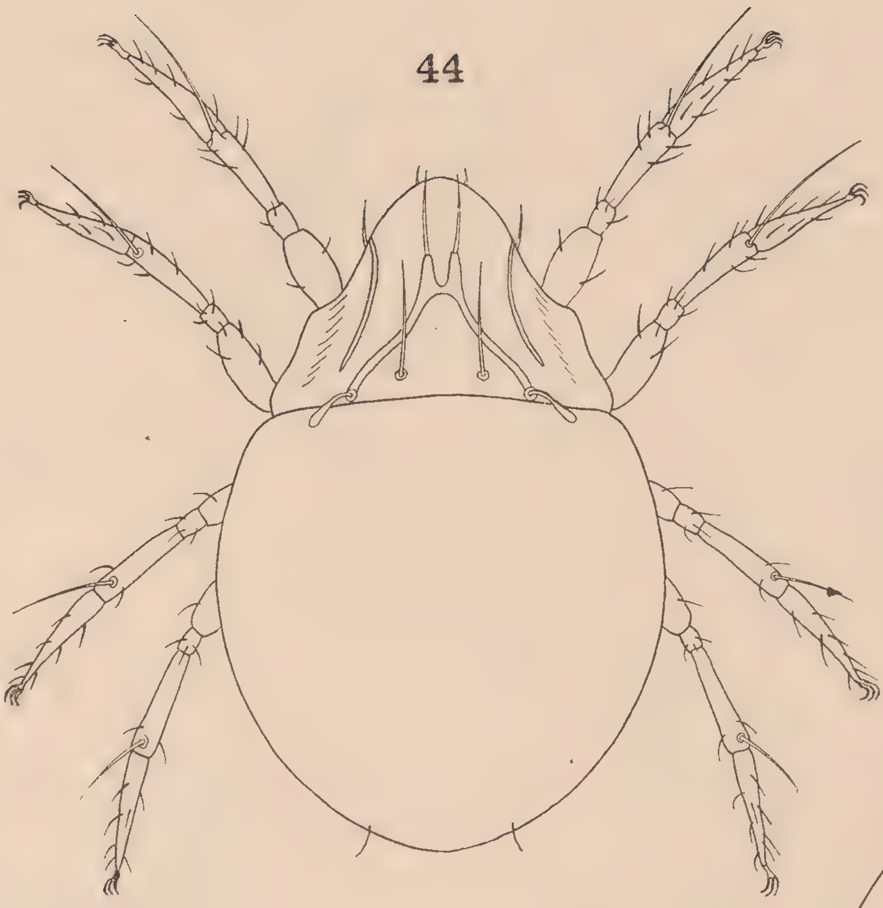


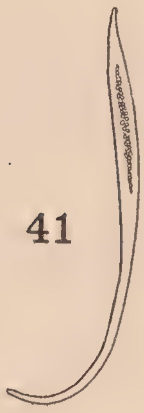
NEW ACARINA.

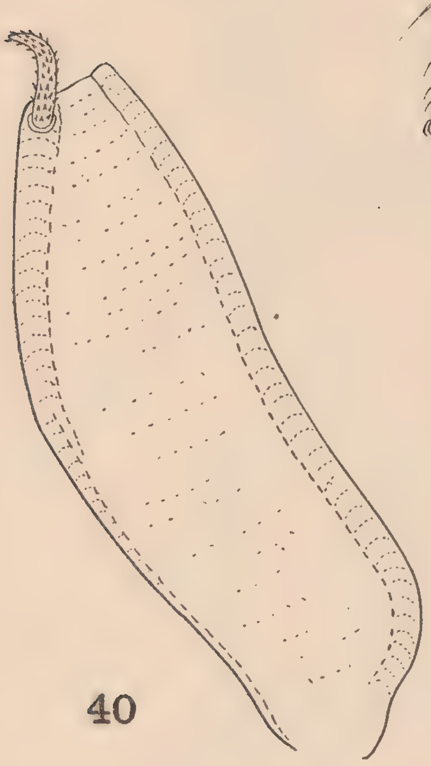


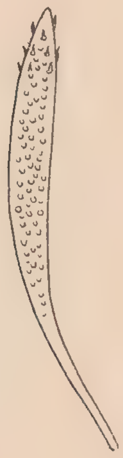
NEW ACARINA.

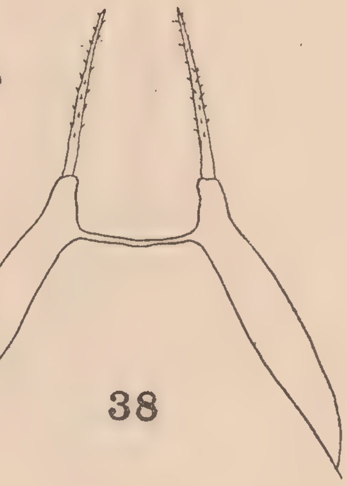

36

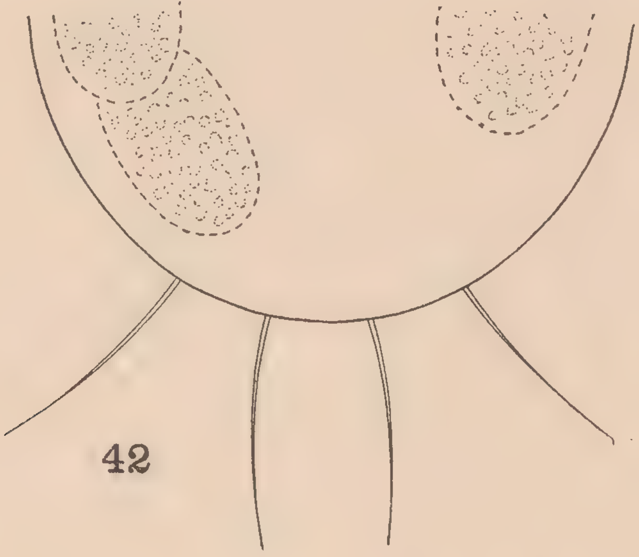

44

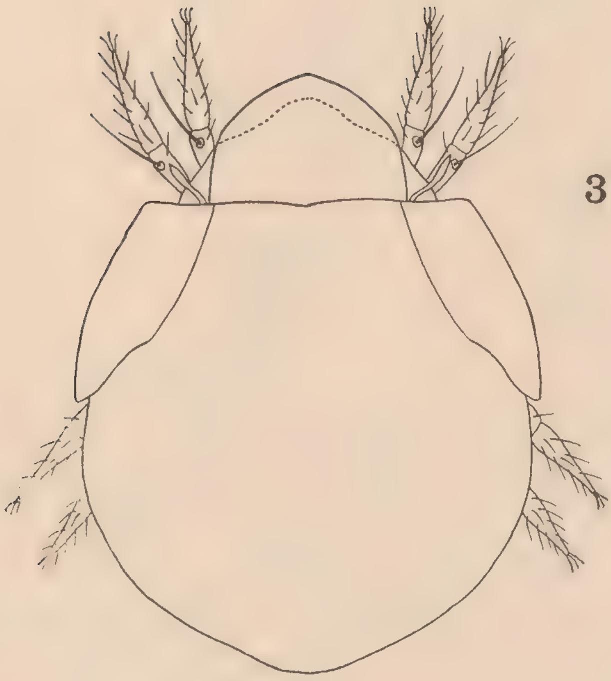

41

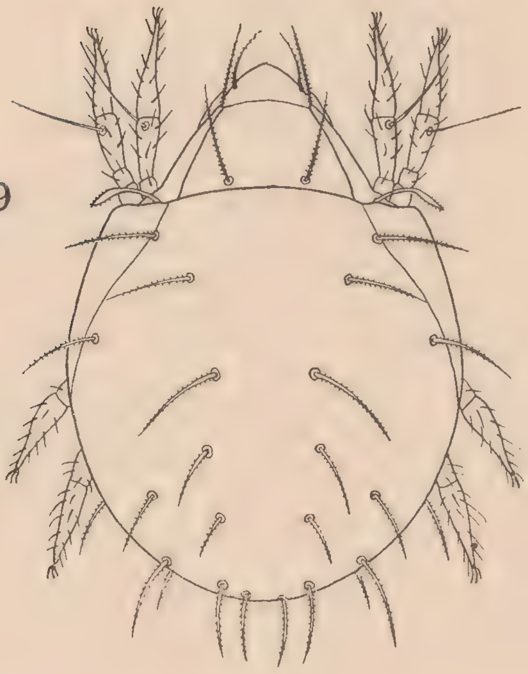

40


43

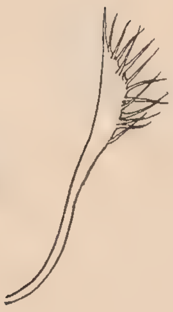

38


42

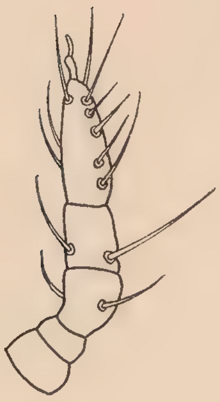

37


39

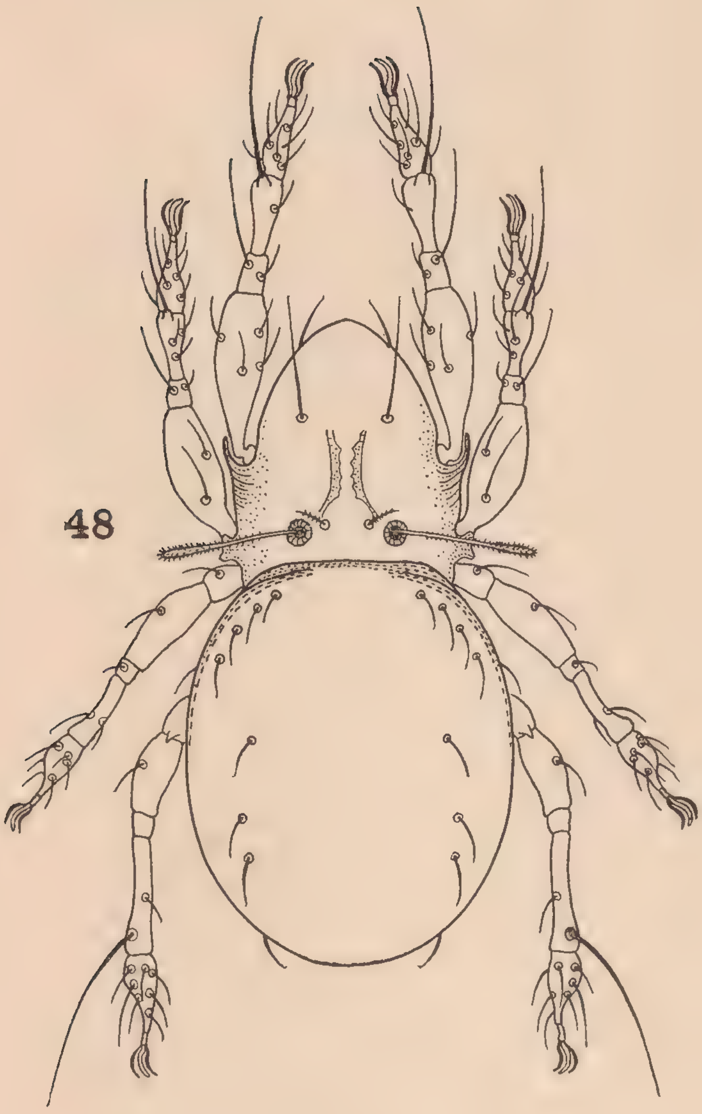
NEW ACARINA.



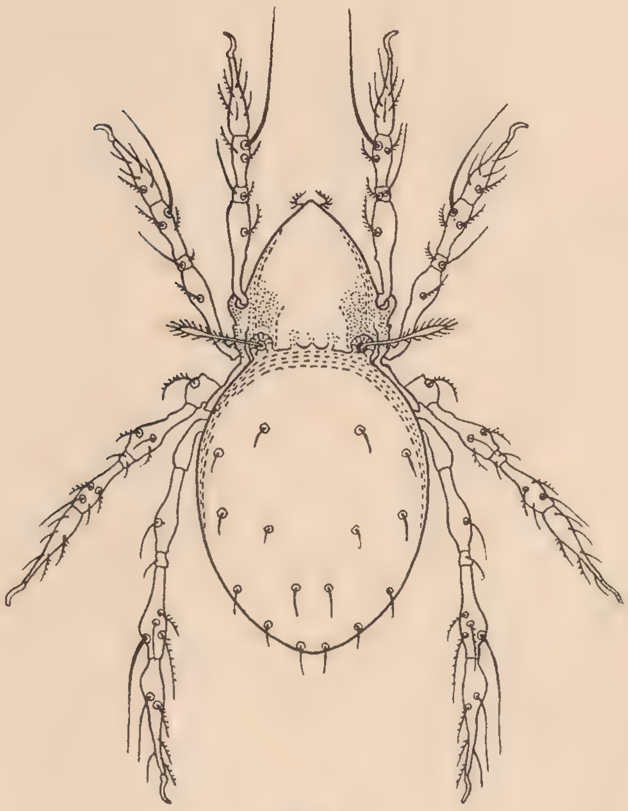
49



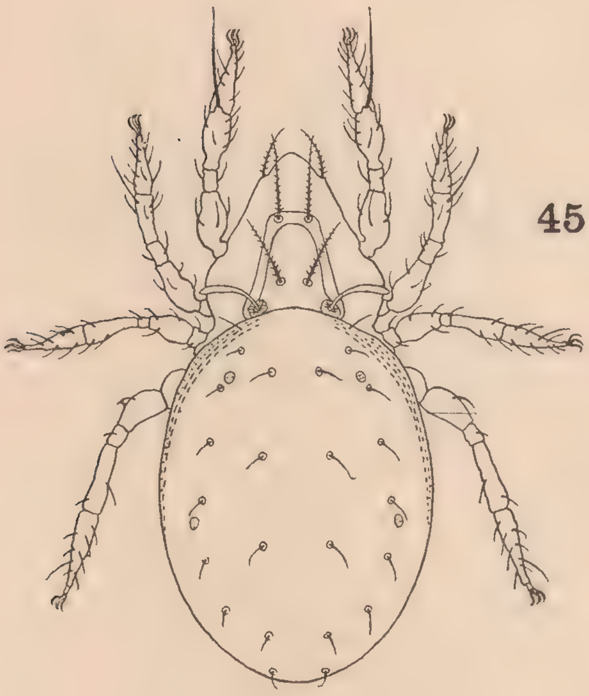
50



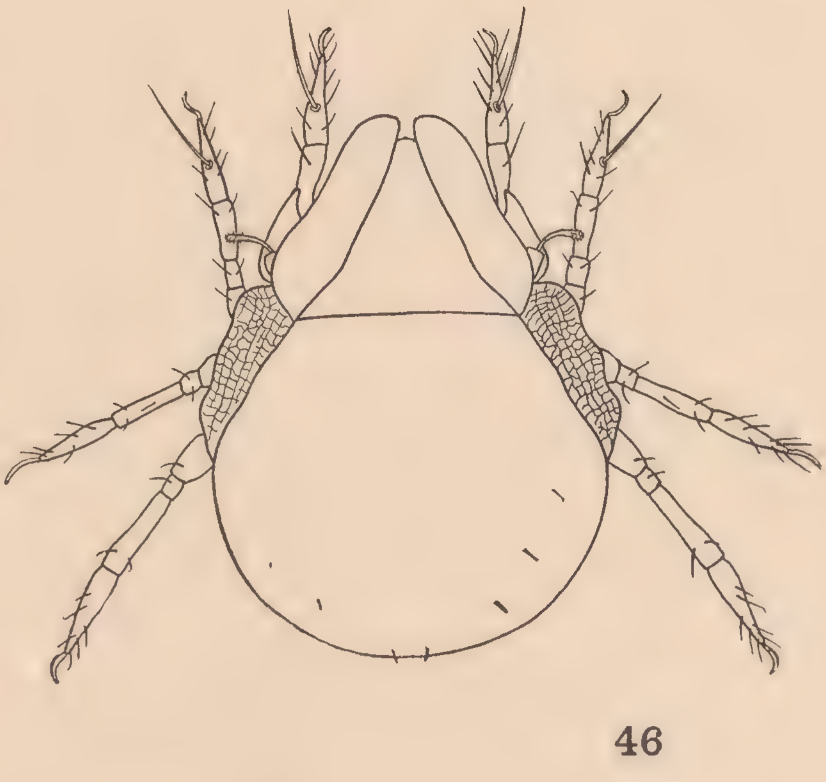
48



47



45



46

New Acarina.

55.2,34(74.8)

Article III.— PRE-CAMBRIAN AND TRIASSIC DIABASE IN EASTERN PENNSYLVANIA.

By Anna I. Jonas.

With Map.

CONTENTS.

Page.

I. Introduction 173
  1. Location and General Relations 173
II. Topography 174
  1. Appalachian Mountains 174
  2. Piedmont Plateau 174
III. Descriptive Geology 175
  Geology of the Boyertown Hills.
  1. General Relations 175
    a. Graphitic gneiss 175
    b. Franklin limestone 175
    c. Granite 176
    d. Diorite 176
    e. Gabbro 176
    f. Palæozoic rocks 177
    g. Diabase 177
  Triassic Rocks of the Piedmont Plateau.
  1. General Relations 178
    a. Brunswick conglomerate 178
    b. Brunswick shale 178
    c. Triassic diabase 179
    Alteration of the shale 180
IV. Conclusion 181

I. Introduction.

Location and general relations.— The region to be discussed occupies part of two adjoining quadrangles, the Boyertown and the Quakertown, contained in parts of Montgomery, Berks, Lehigh, and Bucks counties, Pennsylvania. The area of these quadrangles lies in the Piedmont Plateau and the Appalachian Mountains which is the eastern geographic division of the Appalachian Province. In Pennsylvania these mountains have been called the Reading and Durham hills. They enter northern New Jersey from Dutchess County, New York State, and form the Highlands of New

Jersey. Crossing the Delaware River near Easton, they extend southwestward past Bethlehem and Allentown to Reading. The Piedmont Plateau lies to the east of the Reading and Durham hills. The boundary between the two, in the area of the Boyertown-Quakertown quadrangles, extends in a curving and generally northeastern direction from west of Boyertown in the southwestern part of the quadrangle of that name, northeastward across the northwestern corner of the Quakertown quadrangle. The Reading and Durham hills occupy the whole northwestern half of the entire area of the Boyertown quadrangle but only a part of the northwestern ninth of the Quakertown quadrangle. The area southeast of this boundary line in both quadrangles belongs within the Piedmont Plateau.

II. Topography.

Appalachian Mountains.— For convenience that portion of the Reading and Durham hills which is under discussion will be called the Boyertown hills. They comprise a rugged country, well dissected by narrow valleys to a depth of four hundred feet above sea-level. The general elevation is about eight hundred feet, with long, level-topped ridges rising two hundred to four hundred feet above this surface.

Piedmont Plateau.— The Piedmont Plateau of the Boyertown and Quakertown quadrangles is irregular in its topography and altitude but has a marked decrease in elevation from northwest to southeast. Some of the country is flat or gently rolling; some of it is traversed by long narrow ridges; a great part of it is occupied by a long ridge, well broken up into hills, many of which rise conspicuously above the general level. This irregularity in topography is an expression of variability in hardness of the underlying rocks and of differential resistance to erosion. The gently rolling country is underlaid by soft shales, the long ridges by more resistant shales, and the marked topographic feature which is locally called "the Ridge" is formed of hard diabase flanked by indurated shale.

"The Ridge" rises to its greatest height of nine hundred feet to the northeast in Haycock mountain on the Doylestown and Easton quadrangles, and extends southwestward with an average width of two miles to the western central part of the Quakertown quadrangle where it divides and curves northwestward and southwestward to the Boyertown quadrangle.

III. Descriptive Geology.

Geology of the Boyertown Hills.

General relations.— The rocks of the Boyertown hills are a series of pre-Cambrian gneisses, mainly of igneous origin, with which are infolded and infaulted Palæozoic quartzites and limestone. The oldest formations, graphitic gneiss and Franklin limestone, are pre-Cambrian sediments, which were invaded by a granite that swallowed up all but remnants of the country rock. The granitic intrusion was closely followed by intrusions of diorite and gabbro, but the order of intrusion has not been established. Nor does the field evidence indicate whether a laccolithic or batholithic origin is to be assigned to the igneous complex. Dykes of diabase cut all the pre-Cambrian rocks of the region.

Graphitic Gneiss.

Distribution.— The graphitic gneiss is not found in any considerable area. The largest occurs just north of Boyertown and two and one half by three and one half miles are its extreme dimensions. Besides this area there are twenty small ones of irregular shape scattered throughout the Boyertown hills.

Lithologic character.— When fresh the rock is bluish gray in color; it is a usually fine grained, closely banded, granular rock whose constituents are quartz and feldspar, small flakes of bronze biotite and graphite and sometimes a pyroxene or amphibole. The rock weathers to rusty, orange-colored, angular fragments which are thickly scattered throughout the soil. With the graphitic gneiss is always associated white pegmatitic material. A dark gabbroitic gneiss is interbedded, in many places, with the graphitic gneiss in such intimate association that it must be mapped with the graphitic gneiss. It may represent injection of the pre-Cambrian sediments by a gabbro magma or may be a basic sedimentary gneiss called Pochuck by the New Jersey geologists.

Franklin Limestone.

Distribution.— Franklin limestone occurs in eight small lenses scattered throughout the country to a point six miles north of Boyertown. Some of the areas are associated with graphitic gneiss and with the iron ore which abounds in this region.

Lithologic character.— The Franklin limestone varies lithologically from a coarse grained, sugary, calcite rock, dusted with magnetite crystals, to a white fibrous type, speckled with green pinite; the white mineral is diopside with interstitial calcite.

Granite.

Distribution.— The granite, which has the most widespread distribution of the pre-Cambrian gneisses, is well exposed throughout the Boyertown hills. Intrustions of gabbro and diorite render the outlines of the granite area very irregular. In some places gabbro has been injected into the granite in bands that are too small to map, producing an injection gneiss composed of alternate light and dark bands. When not injected by gabbro, the granite possesses a secondary gneissic structure due to pressure and may be called a granite gneiss. Its strike follows the northeast and southwest trend of the Boyertown hills.

Lithologic character.— An abundant and widely distributed variety of granite is a dense, fine to medium grained, pink and green mottled rock. The constituents are quartz, feldspar, biotite, chlorite, and epidote in vein filling, and magnetite. The feldspar is either orthoclase and microperthite or microcline. A less important type is a hornblende granite with accessory oligoclase.

Diorite.

Distribution and field relations.— Diorite is exposed in more than a dozen areas of variable size and shape, occurring as far south in the Boyertown hills as Hill Church and Barto. Its appearance, weathering, and lithologic character are purely igneous. In the field the diorite is separated from the granite by the content of plagioclase which has been verified by microscopic study.

Gabbro.

Distribution.— Gabbro in the Boyertown hills occurs in irregular and dyke like areas. Its extent is subordinate to that of the diorite.

Lithologic character.— The typical rock is a dark greenish black, medium to fine grained, olivine free, augite gabbro. It is frequently quartz bearing. The augite has undergone alteration to hornblende in many cases and much of the gabbro may be called a hornblende gneiss. The feldspar which is of the composition of labradorite is usually saussuritized.

Palæozoic Rocks.

Partially bordering the pre-Cambrian rocks of the Boyertown hills and also occurring within the hills themselves, are areas of Cambrian quartzite and limestone. The contacts of the Palæozoic sediments with the gneisses are unconformable or faulted.

Diabase.

Distribution.— Diabase dykes intrusive in the pre-Cambrian gneisses occur throughout the Boyertown hills. All the exposures are narrow and interrupted. The widest of these dykes occurs one quarter of a mile southeast of Rittenhouse Gap. Though interrupted in outcrop, diabase dykes may be traced several miles along the strike which, in the northwestern part of the hills is northeast and southwest. Northwest of Boyertown the strike is in the opposite direction, northwest and southeast, but it turns to the prevailing northeast-southwest strike just north of Boyertown. Rock exposures in ledges are few and the existence of the diabase is indicated by a trail of bowlders across the country underlaid by the rock.

Lithologic character.— Most of the pre-Cambrian diabase is fine grained. In the field several distinct types appear. The most abundant is a medium to fine grained, almost black diabase, heavily augitic, with sparkling laths of feldspar and pyrite visible. A mottled dark and light green diabase is also common. In this variety the augite is chloritized to a large extent and the feldspar is dulled by alteration; pyrite is also abundant. The result of more complete chloritization is a dense dark green rock which occurs only in a few local outcrops near Barto.

The freshest type of diabase shows in thin section, feldspar, augite, some biotite and pyrite. The texture is ophitic. Plagioclase, which is chiefly labradorite, occurs in thin laths and the interstices are filled by augite. The augite is clouded and much broken up by alteration to chlorite. Some secondary biotite is present and abundant pyrite. In many cases the feldspar is saussuritized and its character obscured but the ophitic arrangement is still visible. The alteration of feldspar and augite may be carried so far that the thin section shows only chlorite, quartz and zoisite. This stage represents the extreme phase of alteration in the pre-Cambrian diabase. Pyrite is an accessory constituent which is characteristic of the pre-Cambrian diabase.

There is a limited occurrence near Gap Hill, of a purplish gray, aphanitic dyke rock. A study of the thin section reveals a trachytic arrangement of orthoclase twinned according to the Carlsbad law and a little chlorite and magnetite in minute specks. The rock is a trachytic rather than a diabasic dyke rock. It also contains pyrite.

Age.— A pre-Cambrian age has been ascribed to the diabase described above for the following reasons. The diabase occurs in pre-Cambrian materials and does not penetrate Cambrian or younger rocks. The diabase has undergone considerable alteration and contains abundant pyrite which is absent from Triassic diabase.

Triassic Rocks of the Piedmont Plateau.

General relations.— The rocks of the Piedmont Plateau which lie southeast of the Boyertown hills are sediments and diabasic intrusions of Triassic age. The sediments were derived from crystalline rocks and were deposited in local lakes and estuaries. Erosion has removed a large part of these sediments and this remnant has been preserved in a long narrow basin produced by faulting and down-warping. Into these sediments were intruded diabase sheets of Triassic age. In the area of the Quakertown quadrangle the diabase is intrusive in the Brunswick conglomerate and shale which is the upper member of the Triassic sediments.

Brunswick Conglomerate.

Distribution.— The Brunswick conglomerate outcrops in irregular areas in the northern part of the quadrangle in the region adjoining the Boyertown hills.

Lithologic character.— It is a coarse grained variegated, reddish purple conglomerate with quartz and limestone pebbles which weather out of the matrix producing a cellular rock. Associated with the conglomerate is a vitreous red quartzite.

Brunswick Shale.

Distribution.— The Brunswick shale which adjoins the conglomerate to the southeast covers, in this region, a widespread area. Its dip is gently northwest in accord with the prevailing dip of the Triassic rocks.

Lithologic character.— The shale is uniformly soft with a few harder sandstone beds. The formation is red in color and breaks up readily into small fragments which are scattered throughout a red clay soil.

Triassic Diabase.

Distribution.— In the area of the Quakertown quadrangle the diabase is in the form of large intrusive sheets and dykes of great extent. The main mass of diabase forms Haycock Mountain in the Doylestown-Easton quadrangles, and extends southwestward into the Quakertown quadrangle with a width of two and one half miles. Near Rock Hill it narrows to one and one half miles but near the western central part of the quadrangle the diabase widens to three miles and divides north and south. Both branches divide again; the northeastern sub-branch sends out three narrow dykes, one of which spreads out into a wide area near the northern central part of the quadrangle and is united by a dyke with the Haycock Mountain end of the mass. The northwestern sub-branch narrows to a hundred feet where it passes into the area of the Boyertown quadrangle. The southern branch narrows to one half mile near Perkiomen Creek where it divides, and its northern sub-branch enters the Boyertown quadrangle; the southern sub-branch extends southward along Perkiomen Creek to a mile from the southern border of the Quakertown quadrangle and turns westward to pass into the area of the Boyertown quadrangle. The diabase gives rise to rough hilly country, thickly covered with large bowlders and for the most part heavily wooded. The prominent topographic feature which it produces is locally known as the "Ridge." There is a large quarry in diabase situated at Rock Hill where the rock is removed for road metal. The farmers break up bowlders by hand and shape the rough stones into paving blocks.

Field relations.— The diabase sheet, which is about 1000 feet thick, cuts the Brunswick formation at various horizons but does not pass below into the middle member of the Triassic sediments. Two excellent contacts of diabase and shale occur in cuts of the Perkiomen branch of the Philadelphia and Reading Railroad, one three quarters of a mile south of Salford, the other just south of Ziegler Station. At both exposures the contacts are nearly vertical and the shale dips 15° to the northwest along a strike discordant to the diabase. Similar relations obtain in the contact south of Rock Hill along the Bethlehem branch of the Philadelphia and Reading Railroad. South of Green Lane in a cutting made for a railroad siding, there is a dyke of diabase three hundred feet wide with vertical contacts with the enclosing shale.

Lithologic character.— The diabase of the greater part of the "Ridge" is light colored, coarse grained, crystalline rock with a distinctly ophitic texture. Its constituents are grayish feldspar and sparkling green augite in almost equal amount. Magnetite and a little biotite and quartz are rarely present. Augite crystals conspicuously mottle the rock in some places. This coarse grained, light colored type is characteristic of the greater part of the Quakertown quadrangle. Another variety which occurs in many places is a medium grained, dark grayish black in color, with ophitic texture. Its constituents are the same as those of the coarse grained type. The diabase near the border of the sheet and of the smaller dykes is very fine in grain. It possesses a bluish gray to greenish black ground mass in which sparkle laths of dark green feldspar. This marked gradation from coarse to fine grain which radiates outward from the centre of the sheet indicates the intrusive character of the diabase and the marked chilling effect of the country rock.

The feldspar is chiefly doubly twinned plagioclase and is acid labradorite with the equal maximum extinction angles from 25° to 30° and of the composition ab50 an50. It occurs in prismatic individuals without terminal faces and occupies about 45% of the rock. There is a scanty amount of quartz and orthoclase in a microperthite intergrowth. Augite which occupies 50% of the rock, is green to brown to yellow in color, slightly frayed and chloritized. It contains inclusions of feldspar which was the first mineral to crystallize and was followed by crystallization of augite in prisms and as interstitial material. Apatite which is a prominent constituent occurs in long slender needles. Magnetite and a scanty amount of bronze biotite are also present. The prominence of the ophitic texture shows that the rock is a true diabase and not a gabbro. In the finer grained varieties the proportion of augite to feldspar is larger but the constituents are the same. Olivine is noticeably absent in the diabase of the Haycock Mountain sheet.

Alteration of the Shale.— The shale adjacent to the diabase has undergone considerable alteration. It has been indurated, its color has been changed from the prevailing red to a bluish black or grayish green. There results a crystalline aphanitic rock which is not separable from fine grained diabase without much care. Useful criteria for separation of the two rocks are faint sparkle of feldspar and a slightly green color present in diabase but lacking in the shale, lack of conchoidal fracture and spheroidal weathering in the shale. The metamorphosed shale is exposed for as much as three sixteenths of a mile in proximity of the diabase contact. Railroad cuttings south of Salford station afford good opportunity for studying the gradation from altered to unaltered shale. Ten feet north of the diabase contact the shale is dense greenish gray and crystalline. Ninety feet north of the green shale is exposed a hard blue shale simulating a fine grained diabase. A half mile further north the shale has become deep purple and softer and in another of a mile has passed into the red and unaltered rock characteristic of the Brunswick formation. At the above locality there is developed in the shale a feature common to the indurated shale of the region; this feature is the presence of round shot like nodules of chlorite pseudomorphs after cordierite. Such a rock has been called a spilosite.[1] After weathering, these nodules give the rock a spotted aspect. Study of the indurated shale in thin section shows a fine grained hornfelds composed chiefly of quartz with scanty feldspar. Sometimes the rock is speckled with fine grains of epidote. Minute magnetite granules are abundant. There are present nodules of cordierite which appear in ordinary light as dark knots in a light quartz ground mass. In many of them the cordierite has been largely replaced by pinite and chlorite.

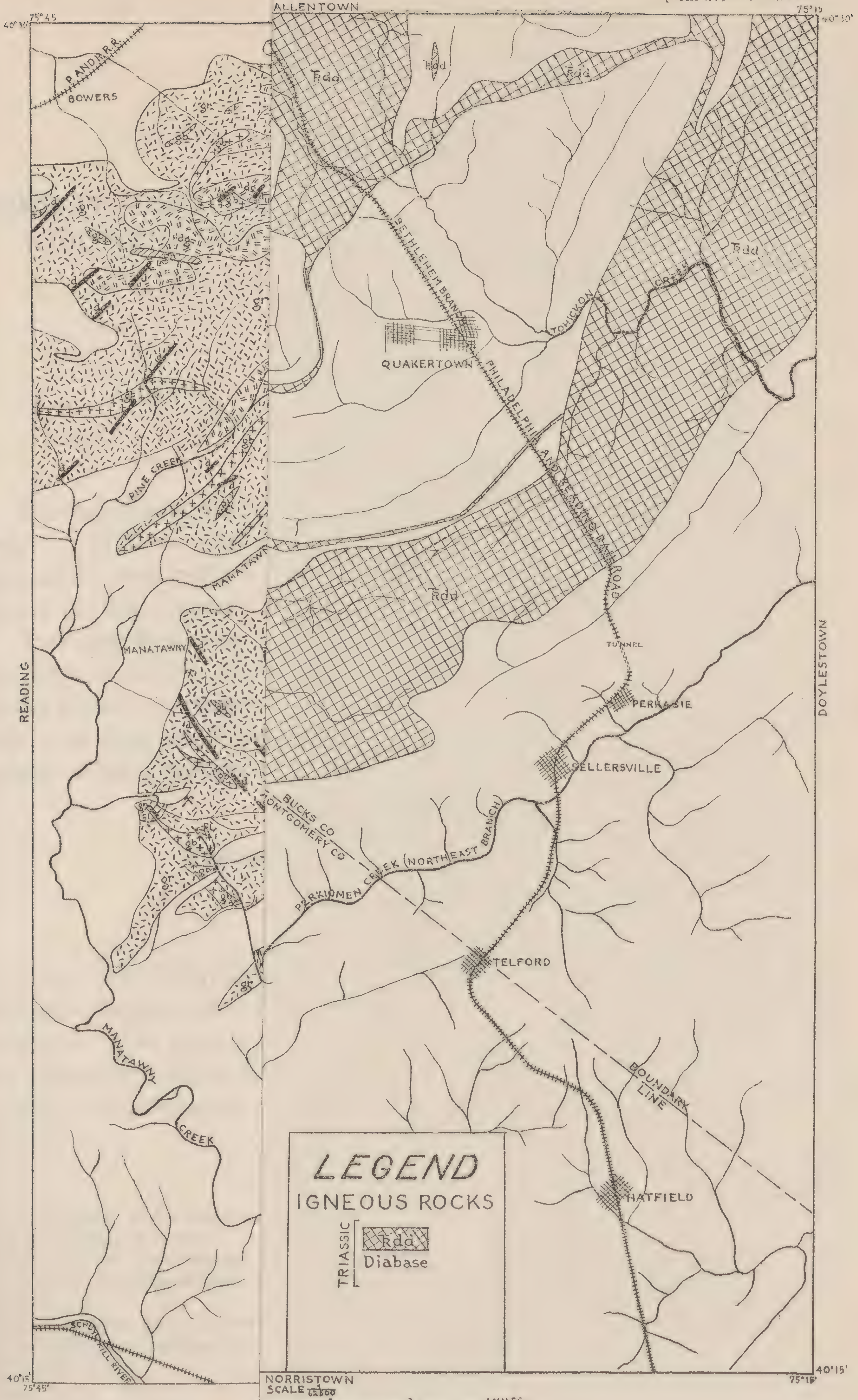
IV. Conclusion.

In addition to the difference in grain between the diabase of the Haycock sheet and that of the Boyertown hills, which is caused by the greater size of the former intrusion, the Haycock diabase possesses certain characteristics by which it is distinguished from the diabase of the Boyertown region. The most prominent characteristic is freshness of the constituents of the diabase of the Haycock sheet; the diabase of the Boyertown hills, on the other hand, has undergone marked alteration; saussuritization of the feldspar and chloritization of the augite has produced a clouding of the rock, has obscured the ophitic texture, and has changed the color. Pyrite is absent in the diabase of the Haycock sheet but is abundant in the diabase of the Boyertown hills. Stratigraphic relations point to a difference in age between the two kinds of diabase under discussion. The field relations readily prove the Triassic age of the Haycock diabase sheet, which has invaded Upper Triassic sediments in the Quakertown Quadrangle. The diabase of the Boyertown hills nowhere penetrates to a horizon younger than the pre-Cambrian. It cannot be traced either into the Palæozoic or into Triassic sediments. Therefore the alteration which is prevalent in the diabase of the Boyertown hills may be explained by their pre-Cambrian age and by the consequent fact that they have undergone greater metamorphism than the diabase of Triassic age.

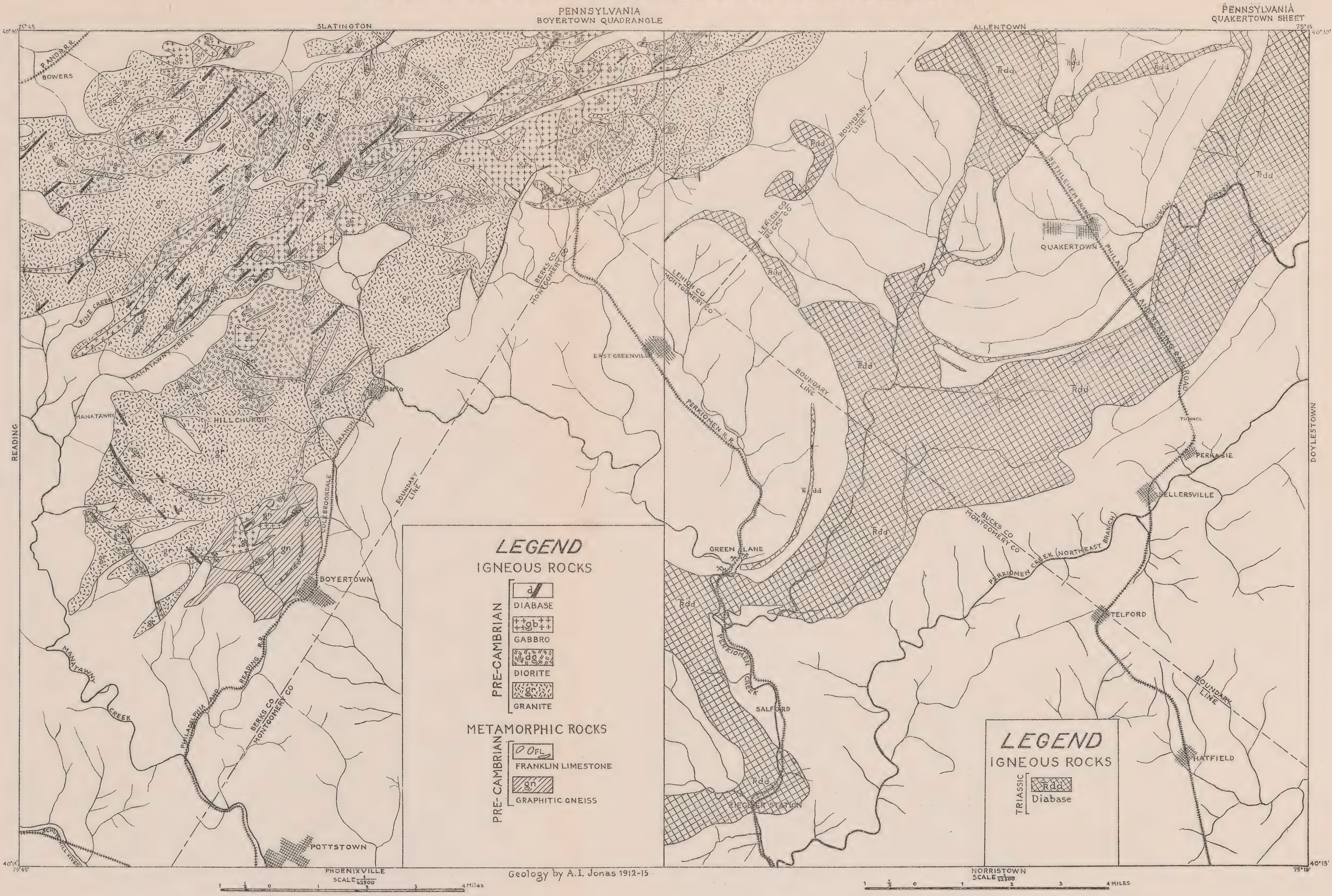
---

[1] J. Volney Lewis, Annual Report of Geological Survey of New Jersey. 1907, p. 138.

PENNSYLVANIA
QUAKERTOWN SHEET



PRE CAMBRIAN AND TRIASSIC DIABASE IN EASTERN PENNSYLVANIA



Geology by A. I. Jonas 1912-15

56.9,32(729.5)

Article IV.— NEW FOSSIL RODENTS FROM PORTO RICO, WITH ADDITIONAL NOTES ON *ELASMODONTOMYS OBLIQUUS* ANTHONY AND *HETEROPSOMYS INSULANS* ANTHONY.

By H. E. Anthony.

Plate V.

Further discoveries resulting from a detailed study of the fossil material collected in Porto Rico in 1916 appear to be of such importance that an immediate description is much more advisable than the deferred description of the final report.[1]

Two new hystricine rodents are added to the fauna of Porto Rico by the discovery of this material. One of them bears a very close resemblance to the already described *Heteropsomys insulans*,[2] the other is of a strikingly new type apparently connected only by subfamily relationships with its nearest relative the Porto Rican *Elasmodontomys obliquus*.[2]

Heptaxodon[3] **bidens** gen. et sp. nov.

Plate V, Fig. 1–6.

Type, No. 17101, Dept. Vert. Pal., from a cave on the property of Don Gervacio Toraño, near Utuado, Porto Rico, July 1, 1916; collector H. E. Anthony. The type is the palatal portion of a skull from just anterior to the zygomatic roots of the maxillæ backward to a line behind the postpalatal notch; two molar teeth are present in a perfect condition and a fragment of a third.

---

[1] This paper is the third of the preliminary papers issued by the author on Porto Rican fossils, the others appearing as follows:

Annals New York Academy Sciences, Vol. XXVII, pp. 193–203. 9 August, 1916.

Bulletin American Museum Natural History, Vol. XXXV, Art. LXI, pp. 725–728. November 16, 1916.

[2] Annals New York Academy Sciences, Vol. XXVII, pp. 199–203. 9 August, 1916.

[3] Heptaxodon: ἕπτᾱχα, in seven parts; ὀδών = ὀδούς, tooth, in reference to the seven plates in the tooth.

The palate is short with a very deep, wide posterior notch which reaches nearly to the line of the first teeth in the molar series and is constricted sharply in front by the converging toothrows. The zygomatic roots of the maxillæ are narrow and proportionally weak, and the antorbital foramen, incomplete in this fragment, appears to be correspondingly small. Anterior to the molar toothrow the palate is curved abruptly away from the plane of the molar crowns.

The dentition presents the most striking feature of this genus. It appears to have but two teeth in each molar series. Certainly if there are three teeth the last one could be scarcely more than a mere rudiment, since the palate is preserved almost to the pterygoid processes, and it is apparent from the fragment that there is room for no more than the two teeth. The first tooth of the series is made up of seven transverse enamel plates alternating with connecting dentine. These laminæ are practically parallel and are oblique to the long axis of the toothrow, thus making the anterior face of the laminæ turn inward toward the palate. The enamel is restricted to the anterior surface of each of the folds formed by the enamel plus the dentine. The last two plates are connected to form a crude spiral by the continuation of the sixth enamel plate internally and posteriorly until it re-enters the dentine from the outside to form the last plate. Although hypothetically formed from primary loops of enamel, the present stage of development shows no trace of a posterior closing enamel wall in any of the laminæ with the exception, cited above, of the last pair of laminæ. The crown surface of this tooth is about twice as long as wide. The second and last tooth of the molar series appears to be an unworn tooth, not yet above the gum, but owing to the condition of the skull fragment the tooth may well be regarded as having dropped deeper into the alveolus than the normal position. Six plates may be counted in this tooth and nothing seems to indicate that it is different from the first tooth of the series, except that it is doubtless a trifle smaller than the first. The two anterior molars have well worn crowns, and these crown surfaces are almost in the same plane. Apparently these teeth have persistent pulps and are rootless.

A mandible found in another cave is presumably of this species and helps to bear out characters expressed by the cranium. Only one tooth, the first of the molar series, is present but the specimen has the appearance of a young animal, and there is a pocket back of the first tooth evidently for the second and last molar tooth. The tooth is made up of five distinct plates which differ noticeably from those of the upper molar. The lower tooth has the enamel completely encircling the first plate, and in the other plates the enamel forms the posterior face of the plate, not the anterior, as in the upper teeth. The plates extend more nearly in the longitudinal than the transverse extent of the molar crown.

Measurements.— Width of palate just anterior to zygomatic roots, 13 mm.; length of palate from post-palatal notch to anterior alveolar border, 14 mm.; length of first tooth of molar series, 11.5 mm.; transverse width of same tooth, 5.5 mm.; length of mandible from posterior border of incisive alveolus to anterior face of condyle, 38 mm.; greatest length of molar tooth (at alveolar plane), 12.5 mm.; transverse extent of same tooth (at alveolar plane), 5 mm.

Relationships.

The generic distinctness of *Heptaxodon* is too apparent to require an extended comparison with genera either from the Antilles or the continental mainlands.

In attempting to place *Heptaxodon* in its proper family I have met anew the difficulty of associating the Porto Rican *Elasmodontomys* with any known family. Apparently *Heptaxodon* has some affiliations with *Elasmodontomys*, just how close is not easy at present to determine. Certainly the relationship does not appear to be closer than that of a subfamily. The reduction in the number of teeth, the increased complexity of the individual tooth, the shortened palate and reduced zygomatic root all point to a long separation from ancestral stock if the two forms ever did have a common ancestor. Comparisons with members of known families had practically convinced me of the distinctness of *Elasmodontomys*.[1] Now the discovery of a new genus with a fundamental similarity in tooth structure influences me to believe that a special line of development has been expressed in the Porto Rico rodents, and that this line has extended for a sufficiently long time and progressed at a sufficiently rapid rate to render the inclusion of *Elasmodontomys* and *Heptaxodon* in the same family permissible only by placing them in separate subfamilies. The differences in structure are such that were it not for the dental characters shared in common — a point that possibly may be proved later to be parallelism, but which seems most unlikely — the two genera would be placed in distinct families. A consideration of Cope's *Amblyrhiza* shows the dental structure of this large rodent to be almost identical with that of *Elasmodontomys*. Plate for plate the teeth of the two genera differ only in size. However in the few cranial characters known *Amblyrhiza* presents well marked differences from *Elasmodontomys*. Cope in his papers on *Amblyrhiza*[2] considered this genus to be related to the Chinchillas, and it is obvious when the material is examined that the resemblances are close and fundamental. Ameghino in papers on the Patagonian fauna[1] and Scott in his Princeton Patagonian Report[2] show that ancestral Chinchillas occurred on the South American continent at a period that bears a most significant relationship to Antillean mammalia. Consequently the facts lead me to the conclusion that these three Antillean genera, *Amblyrhiza*, *Elasmodontomys* and *Heptaxodon*, had very closely related ancestors in the Chinchillidæ. It is expecting too much of parallelism to so consistently develop identical tooth structure in three hystricine genera, the genera moreover being geographically restricted to a greater or less extent through the loss of areas incident to island formation, and consequently would be apt to show wide variation in other characters. The best treatment under the circumstances, a conservative treatment and yet one that does justice to the implied relationships, is as follows:

---

[1] For discussion of this point by Mr. G. S. Miller see Smithsonian Miscellaneous Collections, Vol. 66, No. 12, December 7, 1916, page 3. He also considers an apparent relationship to exist between *Elasmodontomys*, *Amblyrhiza* and *Megamys* from the Santa Cruz.

[2] Cope.— Proc. Acad. Nat. Sci. Phila., 1868, 313; Smithsonian Contributions to Knowledge, 1883, 7.

Family Chinchillidæ.
  Subfamily Amblyrhizinæ.
  Subfamily Elasmodontomyinæ.
  Subfamily Heptaxodontinæ.

The order of the arrangement, beginning with *Amblyrhiza* and ending with *Heptaxodon*, gives the degree of relationship as compared with a typical living chinchillid, *Viscaccia* for example. *Amblyrhiza*, in its elongated premaxillaries and pulled-out mandibular symphysial region, is only slightly less specialized in this respect than *Viscaccia*. *Elasmodontomys* is much more generalized than *Viscaccia*, having a robust and only moderately elongated rostrum. *Heptaxodon*, although the rostrum is unknown, is probably the most specialized member of the family if considered on the basis of the dentition alone. This treatment is based necessarily on cranial characters, both because of the lack of adequate skeletal remains of *Amblyrhiza* and *Heptaxodon* and because graviportal adaptations in the case of *Amblyrhiza* confuse interpretation of characters.

Two fragments belonging evidently to the same skull indicate an animal quite closely related to *Heteropsomys*, although generically distinct. For this rodent I propose the name

---

[1] Ameghino.— Enum. Sist. Especies Mamif. Fós. Patagonia Austral, p. 11, Dec., 1887; Mamif. Fós. Argentina, 1889, 167.

[2] Scott.— Princeton Patagonian Expedition 1896–99, 1903–05, 384.

Homopsomys[1] **antillensis** gen. et sp. nov.

Plate V, Fig. 8.

Type, No. 17102, Dept. Vert. Pal., from a cave on the property of Don Gervacio Toraño, near Utuado, Porto Rico, July 1, 1916; collector H. E. Anthony. Two portions of the same skull make up most of the anterior part of the skull, minus the nasals and zygomatic arches. Teeth are lacking except for part of an incisor and a broken m^2.

The toothrows are parallel and the palate is quite long, the postpalatal notch reaching barely past the posterior face of m^2. The palate from premolar to incisors is gently concave and not abruptly curved away from the plane of the toothrows. The zygomatic roots of the maxillary are of normal proportions and the antorbital foramen is indicated as of good size. The incisive foramina are small and set in a median V-shaped excavation. Above, the skull is noticeably flattened interorbitally. The incisors are quite heavy but little can be said of the maxillary teeth. The alveolus of pm^4 indicates either a reëntrant fold of enamel in the anterior face of the tooth or else the persistence of the roots as separate above the alveolus. The only tooth of this series present, m^2, is broken off just above the roots and its cross-section reveals very little beyond an indication of reëntrants from both the external and posterior faces of the tooth.

Measurements.— Palatal length (postpalatal notch to inside of incisors), 31 mm.; palatal width outside at m^1, 16 mm.; palatal width inside at m^1, 5.4 mm.; width of rostrum across premaxillary (approximate), 14 mm.; length of maxillary toothrow (approximate), 15 mm.; interorbital width posterior to supraorbital processes, 18 mm.

Relationships.

Homopsomys requires close comparison with only the Antillean genera recently described, *Heteropsomys*,[2] *Brotomys*,[3] and *Boromys*.[3] Direct comparison of the new form with the type of *Heteropsomys*, also from Porto Rico, shows marked differences in the length of the palate (much shorter in *Heteropsomys*), in the character of the interorbital region (flatter and more restricted in *Homopsomys*), and in the size of the incisors (apparently much heavier in *Homopsomys*). The relationship, however, may be readily noted, and better material will doubtless show that *Homopsomys* is merely a slightly larger rodent than *Heteropsomys* and nearly congeneric with it.

---

[1] Homopsomys: ὁμός, similar; ὄχ aspect; μῦς, mouse — i. e. similar appearing mouse, in reference to its resemblance to *Heteropsomys*.

[2] Annals New York Academy Sciences, Vol. XXXVII, p. 202. 9 August, 1916.

[3] Smithsonian Miscellaneous Collections, Vol. 66, No. 12, pp. 6, 7. December 7, 1916.

Material is lacking to allow of direct comparisons with *Brotomys* (from Santo Domingo) and *Boromys* (from Cuba) but the type descriptions, aided by Mr. Miller's figures of the former genus, have served to reveal sufficient differences which prevent the reference of the Porto Rican rodent to either of these genera. *Homopsomys* has the palate intermediate in character between *Brotomys* and *Heteropsomys*, noticeably longer than in *Brotomys*. *Homopsomys* apparently has heavier incisors than *Brotomys* and lacks the horizontal anterior zygomatic roots of this genus. In addition, if the alveolar evidence of an anterior reëntrant in pm^4 be true, *Homopsomys* has a radically different premolar from any of the other three genera. As Mr. Miller gives the characters of *Boromys* as quite similar to those of *Brotomys*, I assume that the same characters which separate *Homopsomys* from *Brotomys* separate it also from *Boromys*. Also in *Homopsomys* I find no supplemental neural groove at the base of the antorbital foramen, one of the principal characters given for *Boromys*.

The relationships of *Heteropsomys* and *Homopsomys* appear to be with the mainland Dasyproctidæ. At first sight the high rounded skull of *Heteropsomys* strongly suggests *Dasyprocta*, and this suggestion is strengthened by a detailed comparison with *Dasyprocta rubrata* from Trinidad. The molar pattern is not identical in the two forms but nevertheless the similarity in the general pattern is close enough to show that the molar of the earlier *Heteropsomys* type might very easily become identical with the molar of *Dasyprocta*. Structure for structure the relationship is expressed sufficiently to bring the two forms into the same family, at least on the basis of available material. Both *Heteropsomys* and *Dasyprocta* have rounded braincases, depressed posteriorly, a well developed supraorbital process on the frontal, incisive foramina opening toward a median excavation, proportionally weak incisors, parallel toothrows, a very large foramen magnum, and a zygomatic arch that is fundamentally similar, although in *Heteropsomys* the jugal is much more specialized than in *Dasyprocta*. The most important points of difference between the two forms, in addition to that of the jugals, is the retreat of the incisive foramina in *Dasyprocta* so that the maxillary-premaxillary suture is free from the openings, while in *Heteropsomys* the median excavation is partly in either element; the supraorbital process is more in the superior position in *Heteropsomys*, being practically a postorbital projection in *Dasyprocta;* and the palate of *Heteropsomys* terminates with a narrow V-shaped notch as contrasted with the broad U-shape of *Dasyprocta*.

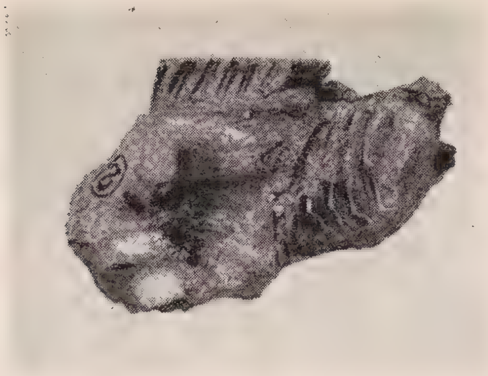
A comparison between the Paca, *Agouti paca,* and *Dasyprocta* has a significant bearing on the case. *Agouti* is found to be specialized mainly in those characters wherein *Heteropsomys* and *Dasyprocta* differ, seeming to show that these characters are the most unstable for the family. To be explicit, *Agouti* has greatly developed jugals (together with enlarged maxillary roots), the incisive foramina are near the sutural line, and the palatal notch is narrow and V-shaped. In other respects it is quite similar to *Dasyprocta* and also to *Heteropsomys.*

However, the relationships between *Heteropsomys* and *Dasyprocta* are best expressed by a subfamily division which I hereby propose, the **Heteropsomyinæ**, with *Heteropsomys insulans* as type.

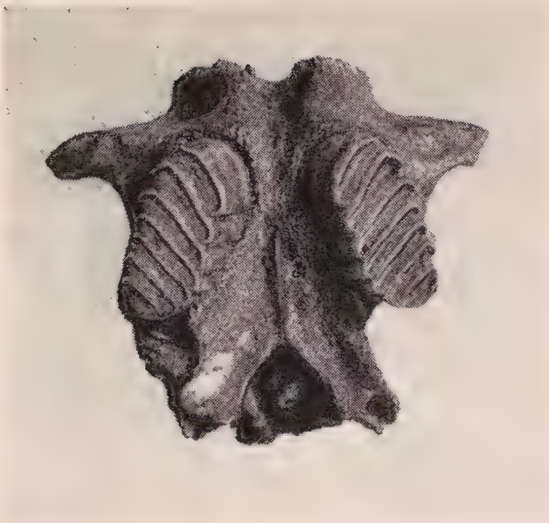
Mr. G. S. Miller (*l. c.*, pages 3 and 6) compares *Heteropsomys* and his genus *Brotomys* with the Spiny Rats. I can find no such points of agreement in the Spiny Rats as I find in the Agoutis, using the type material of *Heteropsomys,* which is an almost complete skull giving many characters. While obviously differing considerably from any living Agouti, *Heteropsomys* differs even more (it appears to me) from any known Spiny Rat and the possibilities of evolving the one from the other seem remote indeed.

EXPLANATION OF PLATE V.

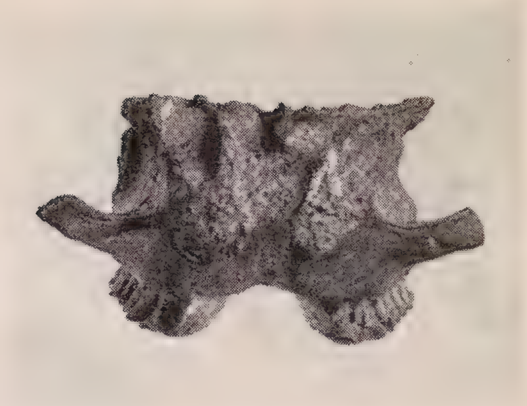
Figures 1–6. *Heptaxodon bidens* type.
  Figs. 1–4. Natural size.
  Fig. 5.— First tooth of upper molar series, twice nat. size.
  Fig. 6.— First tooth of lower molar series, twice nat. size.
Figure 7.— Upper molar series of *Elasmodontomys obliquus,* twice nat. size.
Figure 8.— *Homopsomys antillensis* type, nat. size.
Figure 9.— Last two teeth of upper molar series of *Amblyrhiza inundata,* twice nat. size.



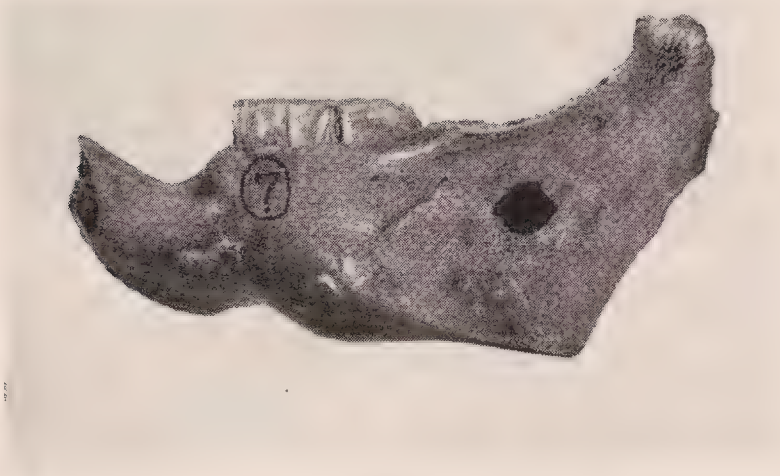
1



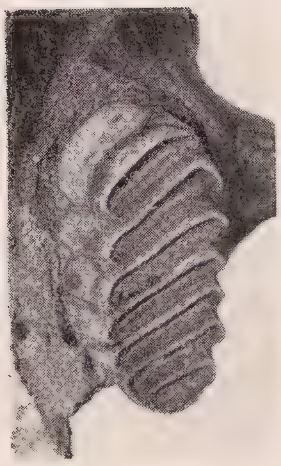
2



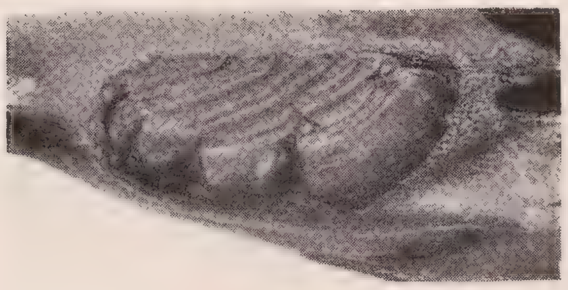
3



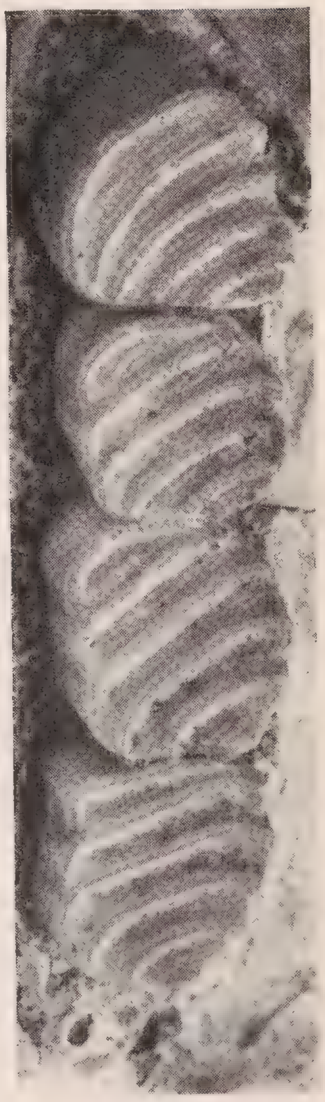
4



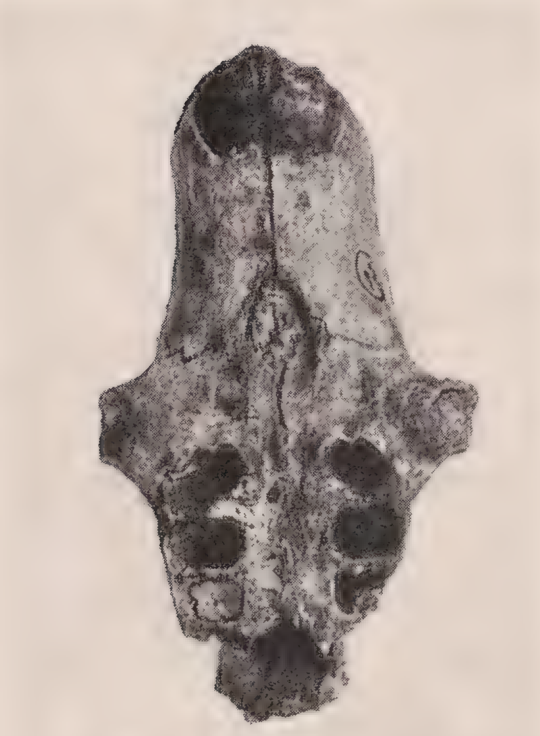
5



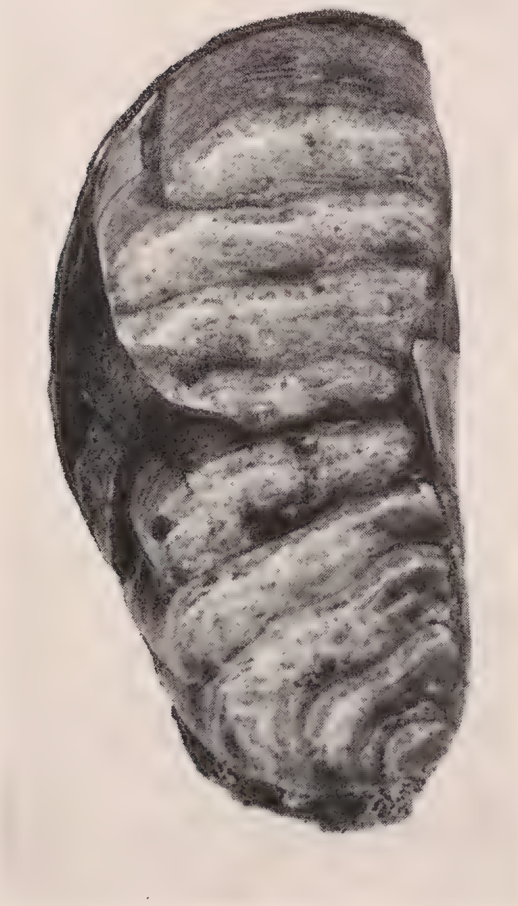
6



7



8



9

FOSSIL RODENTS FROM PORTO RICO.

Figs. 1–6, *Heptaxodon bidens;* Fig. 7, *Elasmodontomys obliquus;* Fig. 8, *Homopsömys antillensis;* Fig. 9, *Amblyrhiza inundata* (from Anguilla).

59.57.6(729)

Article V. — SUPPLEMENT TO PRELIMINARY LIST OF THE COLEOPTERA OF THE WEST INDIES.

By Charles W. Leng, B. S., Honorary Curator of Coleoptera and Andrew J. Mutchler, Assistant.

In the preface to the Preliminary List of the Coleoptera of the West Indies[1] we asked our readers to communicate any papers or manuscript notes bearing on the subject and expressed the hope of publishing later the records of the collections in this and possibly other museums. We have received a number of such communications in response to our request and have examined the material in the National Museum. To all who have thus aided us we are grateful, but particularly to Mr. E. A. Schwarz, to whose great knowledge of the subject and great patience and liberality in communicating his knowledge to us we owe much more than we can repay. In addition to the identified specimens, now added to the published records, there exists in this and other museums, a mass of unidentified material consisting largely of undescribed species of which at present no satisfactory records can be published. The additions (about 200), corrections, and notes that follow are derived either from the sources named or from the extensive West Indian material accumulated in American Museum and are in each instance credited to the proper source by an abbreviation. The explanation of such abbreviations and, concurrently, the authorities are given in the following list.

A. M. N. H. Specimens in American Museum of Natural History collections identified by Andrew J. Mutchler.

Arrow, Gilbert J. In letter, and Ann. and Mag. Nat. Hist., 8th ser., VIII, 1911, p. 151; *ibid.*, 8th ser., XV, 1915, p. 443.

Ballou, H. A. Bull. Entom. Research, 1913; and West Indian Bulletin, XIV, 1914.

Barber, C. A. Supplement to the Leeward Islands Gazette, Jan. 25, 1894.

Barber, H. S. In letters, and Proc. Entom. Soc. Washington, XV, 1913, pp. 188–193; XVIII, 1916, pp. 113–117.

Cameron, M. Entom. Monthly Magazine, 2d ser., XLIX, (XXIV), 1913, p. 175.

Casey, Thos. L. Memoirs on the Coleoptera, VII, 1916.

Champion, G. C. Entom. Monthly Magazine, 3 ser., LI(I), 1915, p. 121; Trans. Entom. Soc. London, 1916, pp. 61–62.

Clavareau, H. Coleopterorum Catalogus, part 59, 1914.

Cockerell, T. D. A. Journal Jamaica Institute, 1891–1893.

Coquerel, Charles. Ann. Soc. Entom. France, 2d ser., VII, 1849, pp. 450–452.

---

[1] Bulletin American Museum of Natural History, XXXIII, Art. XXX, 1914, pp. 391–493.

Desbordes, H. Bull. Soc. Entom. France, 1914, p. 234.
Ehlers, W. Trans. Amer. Entom. Soc., XI, 1883, p. 36.
Fleutiaux, Ed. In letters, and Liste des Coléoptères de la Guadeloupe par Fleutiaux et Sallé, Ann. Soc. Entom. France, 6th ser., IX, 1889, pp. 351–484; supplements by A. Raffray and A. Grouvelle: *ibid.*, LXXI, 1902, pp. 756–769; *ibid.*, LXXVII, 1908, pp. 33–64; *ibid.*, LXXI, 1912, pp. 289–312. Revision des Trixagidæ, Melasidæ et Elateridæ des Antilles, *ibid.*, LXXX, 1911–1912, pp. 235–264.
Grieve, Symington. Proc. Roy. Phys. Soc. Edinburgh, IX, 1913–1914.
Grouvelle, A. Bull. Soc. Entom. France, 1916, pp. 84–87.
Gundlach, Juan. Annales de la Sociedad Espanola de Historia Natural, serie II, tomo secundo, 1894, pp. 601–658 (Fauna Puerto Riquena, pp. 287–344). This work was inaccessible to us at the time the Preliminary List was written; it contains a large number of Porto Rico records. Some of the species cited have, however, never been described and are not included by us.
Hopkins, A. D. U. S. Department of Agriculture, Office of the Secretary, Report No. 99, 1915.
Horn, Walther. Genera Insectorum, Coleoptera, Fascicule 82, *a*, *b*, *c*.
Jones, Thomas H. Insects Affecting Vegetable Crops in Porto Rico. Bulletin of the U. S. Department of Agriculture, No. 192, 1915.
Kerremans, Ch. Monographie des Buprestides, I–VII, pt. 8, 1906–1914.
Kleine, R. Berl. Ent. Zeitsch., 1908; Ent. Blatter, VI, 1910.
Lameere, A. Coleopterorum Catalogus, pt. 52, 1913.
Leng, C. W. and Mutchler, A. J. Bull. Amer. Mus. Nat. History, XXXV, pp. 681–698.
Mann, W. M. Psyche, XXII, 1915, pp. 163, 164.
Marshall, Guy A. H. Ann. and Mag. Nat. Hist., XVIII, 8th ser., 1916, pp. 450–469.
Marshall, Rev. T. A. Trans. Entom. Soc. London, 1878, Proc. pp. 27–38.
Mutchler, A. J. Bull. Amer. Mus. Nat. History, XXXIII, 1914, pp. 345, 346.
Putzeys, J. Stett. Ent. Zeitung, 1878, p. 25.
Quaintance, A. L. Proc. Entom. Soc. of Washington, XV, 1913, pp. 75–82.
Robinson, Col. Wirt. In letters.
Schwarz, E. A. In letters.
Shoemaker, Ernest. A series collected in St. Thomas by Clarence Shoemaker, which has been at our disposal for inspection, has furnished some records.
Spaeth, F. Coleopterorum Catalogus, part 62, 1914.
U. S. N. M. Specimens in the United States National Museum, identified by E. A. Schwarz; records copied by permission of Dr. Leland O. Howard, Honorary Curator, Dept. of Insects.
Urich, F. W. Trinidad Field Nat. Club, I, 1892.
Wickham, H. F. In letters.

The statement in the Preliminary List " total absence of the Silphidæ", requires modification. While true of *Silpha* and *Necrophorus* and of Burying Beetles in the sense we intended, it is not true of all Silphidæ, as that family is composed in the Henshaw Check List. There is a species of *Aglyptonotus* in the British Museum from St. Vincent and Grenada (Ent. Mont. Mag., LI., p. 121). Mr. Schwarz has collected a species of *Aglyptonotus* at Cayamas, Cuba, and the National Museum contains specimens of a *Ptomophagus* or *Choleva* from Porto Rico. These are certainties; there is furthermore a probability that species of *Scotocryptus* or *Parabystus* will be found, as they are inquilinous on Melipone bees, which occur in the West Indies (Schwarz).

The islands of Trinidad and Tobago, which are politically part of the West Indies, are situated close to the mainland of South America, of which faunistically they become part. In Cicindelinæ the introduction of Trinidad records would require the addition of four species of the genus *Odontochila* (Trinidad Field Nat. Club, I, 1892, p. 109, and Walther Horn in Gen. Ins.) and, in other families, many similarly alien records. We shall, therefore, in future omit from the West Indian List species and genera occurring only in the islands above named.

In the following pages the additional records of distribution and the species to be added to our Preliminary List, the latter being indicated by asterisks, are arranged according to that List; errors which have been noticed are corrected, and various other items of interest are included. It will be noted that an atmosphere of doubt, necessarily surrounding records based on the various identifications of different authors in difficult groups, is indicated, but this cannot be dissipated until each of such groups is studied in detail.

Family I. CARABIDÆ.

Subfamily Cicindelinæ.

The authors have published (Bull. American Mus. Nat. Hist., XXV, 1916, pp. 681–698) a Descriptive Catalogue of the West Indian Cicindelinæ which involves the separation of the records for *Tetracha sobrina* and *Cicindela suturalis* to show the distribution of their varieties, the revival of Fleutiaux and Sallé's variety *pallipes* under *argentata*, the description of a new variety of *T. sobrina* from Antigua, and of two new species of *Cicindela* from Cuba. On account of these changes and of numerous additional records, we think it advisable to publish a complete revised list of this subfamily.

Tetracha *Hope.*

Tetracha acutipennis (Dejean). Hispaniola, Cuba.

Tetracha sobrina (Dejean). St. Bartholomew?.

Tetracha sobrina var. *infuscata* (Mannerheim). Hispaniola, Porto Rico, St. Croix, St. Bartholomew.

Tetracha sobrina var. *antiguana* Leng and Mutchler. Antigua.

Tetracha carolina (Linné). Cuba.

Tetracha carolina var. *occidentalis* (Klug). Cuba, Grand Cayman.

Cicindela *Linné.*

Cicindela marginata Fabricius. Bahamas, Cuba.

Cicindela cardini Leng and Mutchler. Cuba.

Cicindela böops Dejean. Cuba, Hispaniola, Porto Rico.

Cicindela olivacea Chaudoir. Cuba.

Cicindela trifasciata Fabricius. Bahamas, Cuba, Grand Cayman, Hispaniola, Porto Rico, St. Thomas, Jamaica, Barbuda, Antigua, Guadeloupe.

Cicindela suturalis Fabricius. Hispaniola, Porto Rico, St. Thomas, St. Bartholomew, Barbuda, Antigua, Guadeloupe, Martinique, Barbados, St. Vincent, Grenada.

Cicindela suturalis var. *hebrœa* Klug. St. Domingo, Porto Rico, Antigua.

Cicindela suturalis var. *guadeloupensis* Fleutiaux and Sallé. Guadeloupe.

Cicindela viridicollis Dejean. Cuba.

Cicindela argentata var. *pallipes* Fleutiaux and Sallé. Guadeloupe.

Cicindela cubana Leng and Mutchler. Cuba.

Subfamily CARABINÆ.

Bembidium fastidiosum (Laferte). Antigua (Putzeys).

* *Tachys picturatus* Putzeys. Antigua (Putzeys).

Tachyta autumnalis Bates. Cuba, Montserrat (U. S. N. M.).

* *Pterocharis eggersi* Ehlers. St. Thomas (Tr. Am. Ent. Soc., 1883, p. 36).

Lachnophorus leucopterus Chevrolat. Porto Rico (A. M. N. H.).

Selenophorus alternans Dejean. Porto Rico (Gundlach).

Selenophorus chalybæus Dejean. Jamaica, Bahamas (U. S. N. M.); Antigua (Putzeys); Guadeloupe (Fleutiaux).

* *Selenophorus integer* (Fabricius). Guadeloupe (Fleutiaux).

Selenophorus discopunctatus Dejean. Haiti, Porto Rico (U. S. N. M.); Antigua (Putzeys).

Selenophorus flavilabris Dejean. Porto Rico (A. M. N. H.).

Selenophorus parumpunctatus Dejean. Porto Rico (Gundlach).

Selenophorus propinquus Putzeys. Antigua (Putzeys).

Selenophorus pyritosus Dejean. Porto Rico (Gundlach).

Selenophorus sinuatus (Gyllenhal). Antigua (Putzeys).

Putzeys (Stett. Ent. Zeit., 1878) treats *S. cuprinus* Dejean as a synonym of *S. discopunctatus* Dejean and *S. æneocupreus* Dejean as a form of *S. beauvoisi* Dejean, established on darker specimens with the sides of thorax less rounded and other details.

Gynandropus guadeloupensis Fleutiaux. Porto Rico (U. S. N. M.).

Amblygnathus vitraci Fleutiaux. Dominica (U. S. N. M.).

* *Euphorticus pubescens* var. *æneolus* Bates. Cuba (U. S. N. M.).

Colpodes ellipticus Chaudoir. Guadeloupe (U. S. N. M.).

Stenous tibialis (Chevrolat). Porto Rico (Gundlach).

* *Panagæus fasciatus* Say. Porto Rico (Gundlach).

* *Panagæus thomæ* Schaum. Cuba (U. S. N. M.). This has been treated as a synonym of the Mexican *quadrisignatus* but is possibly distinct.

Panagæus quadrisignatus Chevrolat. Cuba, Porto Rico (A. M. N. H.).

Aspidoglossa vulnerata Putzeys. Cuba, Porto Rico (Gundlach).

* *Clivina bipustulata* (Fabricius). Cuba (A. M. N. H.); it is possible that this and the preceding records refer to the same insect.

Oxydrepanus rufus (Putzeys). Guadeloupe (Fleutiaux).

Stratiotes iracundus Putzeys. Dominica (A. M. N. H.).

Morio monilicornis (Latreille). Porto Rico, Culebra, Jamaica, Haiti; possibly introduced in pine lumber from the United States (Schwarz).

Coptodera festiva Dejean. Jamaica (U. S. N. M.).

Rhombodera flavipes (*pallipes* err. typ.) Leconte. Occurs also in Jamaica (U. S. N. M.).

Rhombodera bicolor Leconte which may be a variety of *flavipes* (Leconte), (compare G. H. Horn, Tran. Am. Ent. Soc., X, p. 159) and possibly not different from *atrorufa* Reiche. Porto Rico (Gundlach and Van Zwaluwenburg).

Lebia viridis Say. Dominica, Porto Rico (A. M. N. H.).

Lebia bitæniata Chevrolat. Dominica, Porto Rico (U. S. N. M.).

* *Lebia elevata* (Fabricius)? Guadeloupe. The identity of the Guadeloupe insect is doubtful. See Fleutiaux, Ann. Ent. Soc. Fr., 1889, p. 361.

* *Apenes opaca* Leconte. Bahamas (Wickham).

Apenes parallela Dejean and *A. morio* (Dejean) may be synonymous.

Apenes parallela (Dejean). Bahamas (A. M. N. H.).

* *Apenes variegata* (Dejean). Antigua (Putzeys). Under this name both Van Zwaluwenburg and Gundlach record a species from Porto Rico in the genus *Cymindis;* it seems probable, however, that all the West Indies species recorded in that genus really belong to *Apenes.*

* *Zuphium americanum* Dejean. Porto Rico (Gundlach, A. M. N. H.).

Brachinus gilvipes Mannerheim. Porto Rico (Gundlach).

Galerita beauvoisi Chaudoir. Barbados (Cockerell).

* *Casnonia insignis* (Chaudoir). Porto Rico (Gundlach).

Calosoma alternans Fabricius. St. Croix (U. S. N. M.); St. Vincent, Barbuda (W. I. Bull.).

The American species, * *C. calidum* (Fabricius) is also credited to Porto Rico by Van Zwaluwenburg, but the identification may be subject to revision.

Family III. DYTISCIDÆ.

Megadytes fraternus Sharp. Porto Rico (Gundlach, U. S. N. M.).

Megadytes giganteus (Castelnau). Porto Rico (Gundlach and Van Zwaluwenburg). The Cuban species may not be identical; it is labelled *l'herminieri* in U. S. N. M. Coll.

Eunectes occidentalis White is a synonym of *E. sticticus* (Linné); also the citation on p. 398 of *Eretes sticticus* (Linné) for the Guadeloupe species is an error, there being but one species involved. The author of *E. occidentalis* appears to be Erichson.

Thermonectes margineguttatus (Aubé). Porto Rico (Gundlach).

Thermonectes circumscriptus (Latreille). Porto Rico (Gundlach); St. Thomas (U. S. N. M.).

Rhantus calidus (Fabricius). Haiti (A. M. N. H.).

Copelatus posticatus (Fabricius). Porto Rico (Gundlach); Haiti, St. Vincent (U. S. N. M.).

Copelatus angustatus Chevrolat. Porto Rico (Gundlach).

* *Celina grossula* Leconte. Cuba (U. S. N. M.).

Laccophilus americanus Aubé (=*proximus*) Porto Rico (Gundlach).

Pachydrus obniger (Chevrolat). Porto Rico (Gundlach).

Family IV. GYRINIDÆ.

Dineutes longimanus (Olivier). Porto Rico (Gundlach); Jamaica (U. S. N. M.).

Dineutes metallicus Aubé. Porto Rico (Gundlach); Guadeloupe (Fleutiaux); Jamaica (U. S. N. M.).

Gyrinus rugifer Regimbart. (?) Dominica (A. M. N. H.).

Family V. HYDROPHILIDÆ.

Hydrochus pallipes Chevrolat. Porto Rico (Gundlach).

* *Hydrochus rugosus* Mulsant. Cuba (A. M. N. H.).

Derallus rudis Sharp. Cuba (A. M. N. H.).

Stethoxus intermedius (Jacquelin Duval). Culebra (U. S. N. M.).

According to Mr. F. Wintersteiner, who has studied our collections of Hydrophilidæ, the West Indian species *intermedius* (Duval) is not identical with the Central American species *ater* (Olivier).

Stethoxus insularis (Castelnau). Porto Rico, St. Kitts (U. S. N. M.).

Hydrophilus tenebrioides (Jacquelin Duval). Martinique (U. S. N. M.); Porto Rico (Gundlach).

Tropisternus chalybeus Castelnau. Cuba, Montserrat, Porto Rico (various).

Tropisternus lateralis (Fabricius). St. Thomas, Jamaica, Porto Rico, St. Kitts, Culebra (various).

Tropisternus collaris (Fabricius). Culebra (U. S. N. M.); Porto Rico (Gundlach).

* *Tropisternus ovalis* Castelnau. Cuba (A. M. N. H.).

* *Philhydrus nebulosus* (Say). Porto Rico (A. M. N. H.).

* *Philhydrus ochracea* Melsheimer (?) Porto Rico (A. M. N. H.).

Philhydrus melanocephalus (Olivier). Porto Rico (Gundlach).

Separate the genera *Dactylosternum* to *Pelosoma* as Family Sphæridiidæ.

Family V*a*. SPHÆRIDIIDÆ.

Dactylosternum abdominale (Fabricius). Cuba, Montserrat, Barbados (U. S. N. M.).

Dactylosternum flavicorne (Mulsant). Porto Rico (Gundlach); Haiti (U. S. N. M.).

* *Dactylosternum advectum* Horn. Porto Rico (A. M. N. H.).

The authority for *D. subdepressum* should be corrected to Castelnau.

Phænonotum estriatum Say. Dominica, Jamaica, Cuba (A. M. N. H.).

* *Phænotypus palmarum* (Schwarz). Dominica (A. M. N. H.).

* *Oosternum costatum* Sharp. Cuba, Porto Rico (U. S. N. M. and A. M. N. H.).

Cercyon nigriceps (Marsham). Jamaica (A. M. N. H.).

* *Cercyon variegatum* Sharp. Dominica (A. M. N. H.).

* *Cercyon quisquilius* (Linné). Jamaica (A. M. N. H.).

The identifications of the American Museum material of Hydrophilidæ and Sphæridiidæ were made by Mr. F. Wintersteiner.

Family VII. PSELAPHIDÆ.

The genus *Ephimia* Reitter appears in Deutsche Ent. Zeit., XXVII, p. 34, as *Ephymia*.

* *Fustiger haytiana* Mann. Haiti (Mann). Psyche, Vol. XXII, 1915, pp. 163, 164.

Family VIII. STAPHYLINIDÆ.

* *Lispinus claviger* Cameron. St. Vincent (Cameron).
* *Lispinus impar* Cameron. St. Vincent (Cameron).
Lispinus insularis Fauvel. Guadeloupe (Fleutiaux).
* *Thoracophorus guadalupensis* Cameron. Grenada, Haiti (Cameron).
Trogophloeus aridus Jacquelin Duval. Porto Rico (Gundlach).
Trogophloeus smithi. The author of this species should be Cameron.
Oxytelus insignitus Gravenhorst. Jamaica (A. M. N. H.).
* *Thinobius miricornis* Cameron. St. Vincent, Grenada (Cameron).
* *Holotrochus smithi* Cameron. St. Vincent (Cameron).
* *Osorius fauveli* Cameron. Haiti (Cameron).
* *Pinophilus vermiformis* Cameron. Mustique (Cameron).
* *Pinophilus latipes* Gravenhorst. Porto Rico (Gundlach).
* *Palaminus insularis* Cameron. Jamaica (Cameron).
* *Palaminus coriaceus* Cameron. Jamaica, Haiti (Cameron).
* *Pæderus thoracicus* Erichson. Martinique (Marshall).
* *Stilicopsis circumflexus* Cameron. Mustique (Cameron).
* *Stilicopsis auripilis* Cameron. Grenada (Cameron).
* *Stamnoderus bernhaueri* Cameron. Jamaica (Cameron).
* *Stamnoderus dissimilis* Cameron. Jamaica (Cameron).
* *Stamnoderus apicalis* Cameron. Jamaica (Cameron).
* *Stamnoderus varians* Cameron. Grenada, St. Vincent (Cameron).
* *Musicoderus nigrocoeruleus* Cameron. Jamaica (Cameron).
* *Megalops læviventris* Cameron. Grenada (Cameron).
* *Megalops humeralis* Cameron. Grenada (Cameron).
* *Megalops smithii* Cameron. St. Vincent (Cameron).
* *Stenus (Mesostenus) lucens* Cameron. Grenada (Cameron).
* *Monista personata* Cameron. Grenada (Cameron).
* *Echiaster waterhousii* Cameron. Grenada (Cameron).
* *Echiaster bupthalmus* Cameron. Mustique, Grenadines, St. Vincent (Cameron).
* *Echiaster sharpi* Cameron. Jamaica (Cameron).
* *Echiaster distinctus* Cameron. Jamaica (Cameron.).
* *Echiaster impressicollis* Cameron. Grenada (Cameron).
* *Stilicus jucundus* Cameron. St. Vincent (Cameron).
* *Stilicus agnatus* Cameron. Grenada (Cameron).
* *Stilicus insularis* Cameron. Jamaica (Cameron).
* *Stilicus cupreus* Cameron. Jamaica (Cameron).
* *Ophiomedon anthracinus* Cameron. St. Vincent (Cameron).

* *Medon cingulatus* Cameron. St. Vincent, Grenada (Cameron).

* *Aderocharis conifer* Cameron. St. Vincent (Cameron).

* *Aderocharis obscurior* Cameron. Grenada (Cameron).

Strike out *Sciocharis bakeri* and *Sciocharella pertenuis* duplicated on same page in *Thinocharis*. Also add near *Scopæus* and *Lathrobium*, the new genus **Micranops* Cameron, and new species *brunneus* Cameron. Jamaica (Cameron).

* *Thinocharis fuscina* Cameron. Grenada (Cameron).

* *Thinocharis smithi* Cameron. Grenada (Cameron).

Lithocharis ochracea (Gravenhorst). Porto Rico (Gundlach).

* *Scopæus marginatus* Cameron. Jamaica (Cameron).

* *Scopæus simplicicollis* Cameron. St. Vincent, Grenada (Cameron).

* *Scopæus antennalis* Cameron. Haiti (Cameron).

* *Scopæus umbra* Sharp. Grenada, Haiti, Jamaica (Cameron).

* *Scopæus angusticollis* Cameron. Grenada (Cameron).

* *Scopæus auripilis* Cameron. St. Vincent, Grenada (Cameron).

Belonuchus gagates Erichson. Jamaica (A. M. N. H.).

Cilea pulchellus (Erichson). Jamaica (Cockerell).

The genus *Coproporus* is possibly not distinct from *Erchomus* (Schwarz).

Family IX. PTILIIDÆ.

Under *Throscidium* change the author of *invisible* to read (Nietner).

Family XI. PHALACRIDÆ.

* *Litolibrus princeps* (Schwarz). Cuba (U. S. N. M.).

* *Acylomus quadrispinosus* Casey. Cuba (Casey).

* *Acylomus detractus* Casey. Cuba (Casey).

* *Acylomus cubiensis* Casey. Cuba (Casey).

Family XII. CORYLOPHIDÆ.

Sacium instabile Matthews. Cuba (U. S. N. M.).

Family XIII. COCCINELLIDÆ.

Megilla maculata (DeGeer). Cuba (A. M. N. H.); Martinique (U. S. N. M.); Guadeloupe (Fleutiaux).

The record of *Hippodamia 13–punctata* (Linné) from the Antilles is questioned by Mr. Schwarz; the species being distinctly northern and its occurrence almost impossible unless introduced. In the same category may be placed the recent records of * *H. convergens* Guérin, Porto Rico (Van Zwaluwenburg); and * *Coccinella 9–notata* Herbst, Cuba (A. M. N. H.).

Psyllobora nana Mulsant. Haiti (A. M. N. H.); Porto Rico (Gundlach).

Psyllobora lineola (Fabricius). Porto Rico (Gundlach); Jamaica (Cockerell).

Cycloneda sanguinea (Linné). Barbados (Cockerell); Antigua (Marshall).

Chilocorus cacti (Linné). Cuba (A. M. N. H.).

Cladis nitidula (Fabricius). St. Lucie (U. S. N. M.).

Exochomus uva Mulsant. Dominica (A. M. N. H.); Martinique (Marshall); Guadeloupe (Fleutiaux).

The name of the genus at the foot of page 410 should read *Thalassa.*

Hyperaspis connectens (Schönherr). St. Kitts (U. S. N. M.).

Hyperaspis apicalis Weise. Haiti (A. M. N. H.).

Scymnus ochroderus var. * *cyanipennis* Mulsant. Antigua (Cockerell).

Scymnus thoracicus (Fabricius). Porto Rico (Gundlach); Guadeloupe (Fleutiaux).

Scymnus loewii Mulsant. Antigua, Montserrat (U. S. N. M.).

The spelling of the specific name under *Cryptolæmus* should be *montrouzieri.*

Family XV. EROTYLIDÆ.

Ægithus clavicornis (Linné). Dominica (U. S. N. M.).

Brachysphœnus marginatus (Olivier). Dominica (A. M. N. H.).

The position of the genus *Diplocœlus* is doubtful and it may have to be removed from Erotylidæ.

Family XVI. COLYDIIDÆ.

Euxestus piciceps Gorham is the same as *E. minor* (Sharp), see Champion Trans. Ent. Soc. Lond. 1913, p. 79, and *E. erithacus* (Chevrolat) is probably not more than a variety of *E. parki* Wollaston.

Philothermus puberulus Schwarz. Montserrat (U. S. N. M.).

* *Nematidium mustela* Pascoe. Cuba (U. S. N. M.).

Auloniun bidentatum (Fabricius). Guadeloupe (Fleutiaux, A. M. N. H.).

The genus *Botrodus* Casey belongs probably to Murmidiinæ; the same applies to the genus *Lapethus* Casey (Grouvelle, Ann. Soc. Ent. France, 1912, pp. 297, 298). The genera *Stylulus* and *Cryptzoon* are misplaced, but there is some doubt as to their family position.

Synchita laticollis (Leconte). Montserrat, Cuba (U. S. N. M.).

Synchita granulata Say. Haiti, Cuba (U. S. N. M.). This and the preceding species probably belong to *Acolobicus*.

* *Acolobicus lineaticollis* (Horn). Cuba (U. S. N. M.).

* *Ditoma carinata* (Leconte). Haiti, Cuba (U. S. N. M.).

* *Lobogestoria gibbicollis* Reitter. Cuba (U. S. N. M.).

Family XVII. MONŒDIDÆ.

There is a question as to whether the genus *Monœdus* was described by Horn or Leconte. The description of the type species appears in a paper by Horn but Leconte's authorship of the species is clearly indicated by Horn's statement that Dr. Leconte communicated the description. The author of the genus, nevertheless, appears to be Horn and our citation should be corrected.

* *Monœdus guttatus* Leconte. Cuba (Champion).

Adimerus dubius Sharp is a synonym of *Monœdus guttatus* Leconte. (Champion, Trans. Ent. Soc. Lond., 1913, p. 73.).

Monœdus lecontei Fleutiaux. Montserrat (U. S. N. M.).

Family XIX. CUCUJIDÆ.

* *Hemipeplus marginipennis* Leconte. Cuba (U. S. N. M.).

Inopeplus præusta Chevrolat. Cuba (U. S. N. M.).

* *Telephanus strictus* Grouvelle. Jamaica (Grouvelle).

* *Telephanus cribratus* Grouvelle. Jamaica (Grouvelle).

Læmophlœus pusillus (Schönherr). Porto Rico (U. S. N. M.).

* *Læmophlœus iteratus* Sharp. St. Vincent, Grenada (U. S. N. M.).

* *Læmophlœus adustus* Leconte. Porto Rico (Gundlach).

Silvanus surinamensis (Linné). Porto Rico (Van Zwaluwenburg).

* *Silvanus rectus* (?) Leconte. Cuba (U. S. N. M.).

Ahasverus advena (Waltl). Porto Rico (Gundlach).

Nausibius dentatus (Marsham). Porto Rico (Gundlach); Haiti (A. M. N. H.). This species is treated as a synonym of *N. clavicornis* Kugelann by Casey (Trans. Am. Ent. Soc., XI, p. 74), Sharp (Biologia Cent. Am., Coleop. II., pt. 1, p. 556) and Blatchley (Beetles of Indiana, p. 564.).

Lathropus costatus Grouvelle. Cuba (U. S. N. M.) is probably identical with the American species.

Family XX. CRYPTOPHAGIDÆ.

Subfamily CRYPTOPHAGINÆ.

Loberus testaceus Reitter. (?) Porto Rico, Haiti (U. S. N. M.).

* *Tomarus acutus* Reitter. Cuba (U. S. N. M.). Possibly identical with a species described from Florida.

Family XXI. TRITOMIDÆ.

Typhœa semirufa Chevrolat. Porto Rico (Gundlach).

Berginus bahamicus Casey. Cuba (U. S. N. M.).

The genus *Berginus* should be removed to Lyctidæ, according to some authors.

Litargus balteatus Leconte. Montserrat, Cuba (U. S. N. M.).

Family XXII. DERMESTIDÆ.

* *Dermestes caninus* Germar. Jamaica (Cockerell).

Dermestes carnivorus Fabricius. Porto Rico (Gundlach).

Dermestes vulpinus Fabricius. Porto Rico (Gundlach).

Globicornis fulvipes Guerin. Porto Rico (Gundlach).

Trogoderma insulare Chevrolat. Porto Rico (Gundlach).

* *Cryptorhopalum scutellare* Arrow. Mustique (Arrow).

Family XXIII. HISTERIDÆ.

* *Acritus atomulus* Marseul. Cuba (U. S. N. M.).

Acritus analis Leconte. Porto Rico (Gundlach).

Carcinops troglodytes (Paykull). Porto Rico (Gundlach).

Epierus waterhousei Marseul. Porto Rico.

* *Epierus cubensis* Casey. Cuba (Casey).

The species cited as *Paromalus parallelus* Leconte may be *P. laterirectus* Marseul.

* *Isolomalus nanulus* Casey. Cuba (Casey).

* *Abrœus dufaui* Desbordes. Guadeloupe (Bull. Soc. Ent. Fr. 1914, p. 234).

Atholus confinis (Erichson). Porto Rico (U. S. N. M.).

Omalodes ruficlavis Marseul. Haiti (U. S. N. M.).

Omalodes klugi Marseul. Porto Rico (Gundlach).

Lioderma interruptum (Marseul). Porto Rico (Gundlach).

Lioderma quadridentatum (Fabricius). Cuba (U. S. N. M.).

Family XXIV. NITIDULIDÆ.

* *Smicrips hypocoroides* (Reitter). Cuba, Bahamas (U. S. N. M.).

Paralindria partita Olliff. Montserrat (U. S. N. M.). The citation of the species as *bipartita* by Fleutiaux and Salle, was followed by us in the Preliminary List.

Lobiopa insularis (Castelnau). Porto Rico (Gundlach).

Stelidota geminata (Say). Porto Rico (Gundlach).

Stelidota ruderata Erichson. Porto Rico (Gundlach).

Haptoncus luteolus (Erichson). Porto Rico (Gundlach). Cosmopolitan, in stores.

Conotelus conicus (Fabricius). Jamaica, Montserrat (U. S. N. M.); Porto Rico (Gundlach).

Brachypeplus mutilatus Erichson. Guadeloupe (Fleutiaux).

Macrostola lutea Murray. Montserrat (Hubbard, Insect Life, VII, pp. 340–345).

* *Platychora lebasi* Erichson. Cuba (U. S. N. M.).

Carpophilus hemipterus (Linné). Haiti (A. M. N. H.); Porto Rico (Van Zwaluwenburg).

Carpophilus dimidiatus (Fabricius). Porto Rico (Van Zwaluwenburg).

Carpophilus dimidiatus var. *mutilatus* Erichson. Vieques, Montserrat (U. S. N. M.).

Carpophilus (*Colopterus*) *amputatus* (Erichson). Bahamas (U. S. N. M.).

Carpophilus (*Colopterus*) *truncatus* (Randall). Cuba.

Rhizophagus keydeni should be *heydeni*.

Family XXV. LATHRIDIIDÆ.

* *Coluocera maderæ* (Wollaston). Haiti (Mann).

Lobogestoria Reitter should be transferred to Colydiidæ. (Schaeffer, Proc. Ent. Soc. Washington, VIII, 1906, p. 141.)

* *Melanophthalma distinguenda* (Comolli). Cuba (U. S. N. M.). Cosmopolitan.

* *Corticaria ferruginea* Motschulsky. Cuba (U. S. N. M.). Cosmopolitan.

Family XXVII. TEMNOCHILIDÆ.

The authority for *Nemosoma* should be Latreille not Reitter.

* *Temnochila hubbardi* Leveillé. Cuba (U. S. N. M.).

Tenebroides transversicollis (Jacquelin Duval). Porto Rico (Gundlach).

Family XXIX. BYRRHIDÆ.

Chelonarium punctatum Fabricius. Porto Rico (Gundlach). The position of the genus *Chelonarium* is uncertain; its species live on bushes, not on the ground like the Byrrhidæ. It is treated as a separate family by Brues and Melander, and is placed in the subfamily Chelonarinæ under Byrrhidæ by Sharp (Biol. Cent. Amer., II, pt. 1, 1902, pp. 684–696); Plate XX referred to in the text was, apparently, never published.

Family XXXII. HELODIDÆ.

Mr. Schwarz has verbally called attention to the differences shown by Peyerimhoff, between the larvæ of Helodidæ, Cyphonidæ and Dascillidæ.

Family XXXVI. ELATERIDÆ.

Adelocera subcostata Candèze. Antigua (Marshall).

Hemirhipus fascicularis (Fabricius). Haiti (A. M. N. H.).

Chalcolepidius obscurus Castelnau. Montserrat, Dominica (U. S. N. M.).

* *Chalcolepidius validus* Candèze. Dominica (U. S. N. M.).

The authority for *Ischiodontus oblitus* should be Candèze.

Dicrepidius ilegans should be *elegans*.

Dicrepidius notus should be *ignotus*.

Monocrepidius bifoveatus (Beauvois). Bahamas, Haiti (U. S. N. M.).

All the species listed as *Conoderus* should be listed as *Monocrepidius*.

Æolus elegans (Fabricius). Porto Rico (Gundlach).

* *Megapenthes sturmii* (Germar). Cuba (U. S. N. M.).

The authority for *Anchastus rufescens* should be Candèze.

For *Pyrophorus ongipennis* read *P. longipennis*.

* *Æaphes decoloratus* (Say). Antigua (Marshall).

Glyphonyx quadraticollis Champion. Cuba (A. M. N. H.).

Family XXXVII. TRIXAGIDÆ.

Drapetes tunicatus Bonvouloir. Haiti (U. S. N. M.).

Family XXXVIII. BUPRESTIDÆ.

According to Kerremans' Monograph, the following changes should be made:

Polycesta thomæ Chevrolat is a synonym of *P. porcata* (Fabricius); *P. angulosa* Jacquelin Duval is a synonym of *P. excavata* Blanchard; *Acmæodera contigua* Kerremans is a synonym of *A. flavomarginata* (Gray); *Halecia aureomicans* (Nonfried) and *Hilarotes chalcoptera* (Jacquelin Duval) are both synonyms of *Halecia nitidicollis* (Castelnau); *Gyascutus carolinensis* Horn belongs in *Hippomelas*.

The identity of *Psiloptera aurifera* (spelled in error *aurifer*) and *aurata* is questionable.

* *Pelecopselaphus strictus* (Linné). Antilles (Kerremans).

Polycesta porcata (Fabricius). St. Thomas (Kerremans).

Acmæodera cruenta (Olivier). Haiti (Kerremans).

Buprestis decora Fabricius. Porto Rico (Gundlach).

Buprestis lineata Fabricius. Porto Rico (Gundlach).

These and other species of *Buprestis* are probably not native but commercially introduced in timber. See also Fleutiaux (Ann. Soc. Ent. Fr., 1889, p. 405) for similar Guadeloupe records.

Melanophila notata (Laporte and Gory). Bahamas (A. M. N. H.).

Chrysobothris lepida Castelnau and Gory. Porto Rico (Gundlach).

Chrysobothris tranquebarica (Gmelin). Porto Rico (Gundlach).

* *Chrysobothris denticulata* Castelnau and Gory. San Domingo, introduced.

Families XXXIX–XLI. LYCIDÆ, LAMPYRIDÆ AND TELEPHORIDÆ.

A descriptive catalogue, in which the numerous changes will be included, is in preparation.

Family XLII. MALACHIIDÆ.

The spelling of the family name requires correction, as above.

Family XLIII. CLERIDÆ.

Thanoclerus should read *Thaneroclerus* and the locality Guadeloupe should be inserted for *T. girodi* Chevrolat; Fleutiaux (Ann. Soc. Ent. Fr., 1889, p. 417) records *T. buqueti* (Lefebvre) with *T. girodi* as a synonym, but *buqueti* being East Indian (Schenckling in Gen. Ins.) *girodi* is probably the the Guadeloupe species.

Family XLIV. PTINIDÆ.

Gibbium psylloides Czempinski. Montserrat (U. S. N. M.). This is a cosmopolitan insect — as are many of the family.

Ptinus niveicollis Boieldieu. Cuba (U. S. N. M.).

Lasioderma serricorne (Fabricius). Cuba (U. S. N. M.); Porto Rico (Van Zwaluwenburg).

Champion's paper, in Trans. Entom. Soc. Lond., 1913, makes some changes in this family: *Ozognathus* is not Antillean and the species referred thereto may be a *Cryptorama; Petalium pulicarium* (Gorham) is a synonym of *P. antillarum* (Pic); *Mirosternus lævis* Gorham belongs to *Eupactus* Leconte; *Priotoma brevis*? Gorham is *P. insularis* Champion.

Xylographus belongs in Cioidæ.

Calymmaderus bibliothecarum (Poey). Porto Rico (Gundlach).

Atractocerus Palisot (not Latreille) belongs in Lymexylonidæ.

Atractocerus brasiliensis (Laporte and Serville) of which *A. antillarum* Vitrac (Insecta, III, 1913, p. 168) is treated as a synonym by Schenckling (Coleopterorum Catalogus, pt. 64, 1915). Jamaica (Cockerell).

Family XLV. BOSTRYCHIDÆ.

Lyctus should be separated as family Lyctidæ which includes also * *Minthea rugicollis* Walker (*Lyctopholis foveicollis* Reitter), St. Domingo (U. S. Tech. Ser. 20, part 3, 1911, p. 138).

The genus *Xylopertha* should be expunged; the species *sextuberculata* is *Zylomeira torquata* (Fabricius); the species *minutus* is cosmopolitan and belongs in *Dinoderus*.

Heterarthron gonagra (Fabricius). Jamaica, Dominica (U. S. N. M.).

* *Heterarthron plicatus* (Leconte). Cuba, Jamaica (U. S. N. M.).

Rhizopertha pusilla (Fabricius). Porto Rico (A. M. N. H.). Cosmopolitan species or introduced from the United States in timber.

* *Sinoxylon floridanum* Horn. Antigua, Jamaica (U. S. N. M.). Cosmopolitan species or introduced from the United States in timber.

Apate francisca Fabricius. Porto Rico (Van Zwaluwenburg).

* *Apate terebrans* (Pallas). Jamaica (reared from *Anacardium occidentale*).

Family XLVI. CIOIDÆ.

Ennearthron delicatulum Jacquelin Duval. Porto Rico (Gundlach).

Strike out *Ceratocis,* transferring the species to *Ceracis*.

Family XLVIII. PASSALIDÆ.

Passalus tlascala Percheron is a *Neleus*.

It is doubtful that *Passalus unicornis* (Serville) occurs in Cuba or Guadeloupe.

Passalus interruptus (Linné). Martinique (Marshall).

Family XLIX. SCARABÆIDÆ.

Chœridium insulare Chevrolat. Montserrat (U. S. N. M.).

* *Canthidium melanocephalum* (Olivier). According to Olivier (Ent., I, 3, pp. 173, 174,) the type of this species was described from Guadeloupe but von Harold, in Coleopterologische Hefte, I, pp. 29–30, gives Brazil as the locality for the species and more recent authors have followed the latter record, excepting Fleutiaux and Sallé, who very likely followed Olivier, as they had no specimens of this species to verify the records.

Aphodius granarius (Linné). Jamaica (A. M. N. H.).

Aphodius granarius var. undescribed. Porto Rico, Cuba, Martinique (U. S. N. M.).

* *Atænius figurator* Harold. Cuba (U. S. N. M.).

Atænius gracilis (Melsheimer). Jamaica (A. M. N. H.).

Atænius imbricatus (Melsheimer). Haïti, Porto Rico (A. M. N. H.).

Atænius rhyticephalus (Chevrolat). Porto Rico (Gundlach).

Atænius stercorator (Fabricius). Porto Rico (U. S. N. M.).

Atænius terminalis (Chevrolat). Haiti, St. Thomas (U. S. N. M.).

Athyreus tridentatus MacLeay var. *castaneus* (Guerin). Bahamas (A. M. N. H.).

Trox suberosus Fabricius. Porto Rico (Gundlach).

Clœotus rufopiceus Arrow. Dominica (A. M. N. H.).

Phyllophaga (*Lachnosterna*) *patruelis* (Chevrolat). St. Kitts (W. I. Bull.).

* *Anomala undulata* Melsheimer. Jamaica (Cockerell).

Macraspis tristis Castelnau. Dominica (A. M. N. H.).

Cyclocephala notata (Illiger). Jamaica (A. M. N. H.).

Cyclocephala tridentata (Fabricius). Dominica (U. S. N. M.).

Rutela formosa Burmeister. Bahamas (A. M. N. H.).

Leucothyreus vicentiæ Arrow. St. Lucie (U. S. N. M.).

Dyscinetus barbatus (Fabricius). Porto Rico (Gundlach, Van Zwaluwenburg).

Dyscinetus trachypygus (Burmeister). Porto Rico (Van Zwaluwenburg).

Dyscinetus picipes (Burmeister). Porto Rico (various).

Ligyrus cordatus (Fabricius). Guadeloupe (Fleutiaux).

Ligyrus juvencus (Fabricius). Cuba (A. M. N. H.).

* *Ligyrus fossulatus* Latreille. (= *fossor* Latr.?) Porto Rico (Gundlach).

Strategus antæus (Fabricius) is an error for *syphax* (Fabricius); *S. julianus* Burmeister is possibly also an error in determination of the species from Grenada (Schwarz).

Strategus tricornis (Verrill) is a synonym of *vulcanus* (Fabricius). (Arrow).

Dynastes argentata, D. lagaii and *D. vulcan* Verrill are synonyms of *D. hercules* (Linné). (Arrow.)

It may be well to repeat that species described from Trinidad, of which there are several in Scarabæidæ, are not included because that island is really South American in respect of fauna.

Family L. CERAMBYCIDÆ.

Parandra lævis Latreille. Jamaica (Waterhouse, Trans. Ent. Soc. Lond. 1878, p. 303).

Mallodon spinibarbis (Linné). Dominica (A. M. N. H.).

Nothopleurus maxillosus (Drury). Porto Rico (Gundlach). The "Barbados" record for this species should be Barbuda.

Stenodontes exsertus (Olivier). Mona (Lameere).

Prosternodes cinnamipennis (Chevrolat). Bahamas (A. M. N. H.).

M. Lameere's work in Coleopterorum Catalogus makes *Dendroblaptus* and *Callomegas* subgenera of *Callipogan, Prostemodes dominicensis* Gahan a *Derancistrus, Solenoptera* a subgenus of *Derancistrus, Orthosoma brunneum* a *Derobrachus.*

Methia punctata Leconte. Porto Rico (Gundlach).

* *Criocephalus cubensis* Mutchler. Cuba (A. M. N. H.).

The spelling of *Achryson surinam* should be *surinamum.* Marshall calls the specimens found in Antigua var. *pallens* (Fabricius).

Chlorida festiva (Linné). Montserrat, Haiti (U. S. N. M.).

Eburia decemmaculata (Fabricius). Dominica (U. S. N. M.).

Elaphidion glabratum (Fabricius). St. Lucie, Dominica, Antigua (W. I. Bull.); Bahamas (A. M. N. H.).

Elaphidion irroratum (Linné). Porto Rico (Gundlach); St. Kitts (Ballou).

Elaphidion nanum (Fabricius). Porto Rico (Gundlach); Bahamas (A. M. N. H.).

Elaphidion signaticolle Chevrolat. Bahamas (A. M. N. H.).

Elaphidion tomentosum Chevrolat. Montserrat, Porto Rico (U. S. N. M.).

* *Heterachthes ebenus* Newman. Cuba (U. S. N. M.).

Cylindera flava (Fabricius). Porto Rico, Bahamas (A. M. N. H.).

Cylindera puberula (Fleutiaux & Salle). Haiti, Bahamas, Jamaica (A. M. N. H.).

Merostenus attenuatus (Chevrolat). Porto Rico (Gundlach).

* *Plectromerus dentipes* (Olivier). Cuba (U. S. N. M.).

Pentomacrus fasciatus Gahan. Cuba (A. M. N. H.).

The generic position of the species assigned to *Stizocera* requires investigation, they may belong to *Peribœum;* also those assigned to *Heterachthes* may belong to *Compsa.*

Callichroma elegans (Olivier). Dominica (U. S. N. M.).

Euryscelis suturalis (Olivier). Bahamas (A. M. N. H.).

Trachyderes succinctus (Linné). St. Thomas (A. M. N. H.); Martinique (Marshall).

Tæniotes scalaris (Fabricius). Martinique (Marshall).

Adetus lherminieri Fleutiaux. Montserrat (U. S. N. M.).

Oncideres amputator (Fabricius). Jamaica (U. S. N. M.).

* *Batocera rubus* (Linné). Barbados (Quaintance); St. Croix (U. S. N. M.); introduced from China.

Steirastoma depressum (Linné). Jamaica (Cockerell); Martinique (U. S. N. M.); a serious pest on *Cacao* (Quaintance).

Lagochirus araneiformis (Linné). Porto Rico (Gundlach).

Leptostylus argentatus (Jacquelin Duval). Haiti (A. M. N. H.).

Leptostylus præmorsus (Fabricius). Dominica, St. Lucie (W. I. Bull.), Antigua (Marshall).

Leptostylus, the species credited to Dejean or Dejean Cat., make Gahan the authority (see Trans. Ent. Soc. London, 1895, pp. 135, 136).

Lepturges guadeloupensis Fleutiaux and Salle. Cuba (U. S. N. M.).

* *Onychocerus scorpio* (Fabricius). Grenada (U. S. N. M.) received from H. A. Ballou.

* *Monohammus titillator* (Fabricius). Cuba, Porto Rico (Gundlach); perhaps introduced from the United States.

Family LI. CHRYSOMELIDÆ.

Lema confusa Chevrolat. Jamaica (U. S. N. M.).

Lema dorsalis Olivier. Haiti (U. S. N. M.).

* *Lema intermedia* Suffrian. Cuba, Haiti (U. S. N. M.).

* *Cryptocephalus squalens* Suffrian. Cuba, Bahamas (U. S. N. M.).

Cryptocephalus viridipennis Suffrian. Jamaica, Porto Rico (A. M. N. H.).

* *Eumolpus imperialis* Baly. Martinique (Clavareau, Coleopterorum Catalogus).

* *Glyptoscelis æneipennis* Baly. Grenada (U. S. N. M.).

* *Glyptoscelis hobsoni* (Curtis). Cuba (Clavareau, Coleopterorum Catalogus).

**Metachroma terminalis* Horn. Cuba (A. M. N. H.).

Numerous changes are made by Clavareau in the Coleopterorum Catalogus, pt. 59: *Noda fusca* is placed in *Glyptoscelis; N. luteicornis* is placed in *Colaspis; Colaspis suffriani* Weise is proposed for *C. nigricornis; Chalcophana furvida* is placed in *Colaspis,* all other species of *Chalcophana* in *Phanæta; Heteraspis nana* is placed in *Glyptoscelis; Metachroma cubæcola* Clavareau is proposed for *M. puncticollis; M. suffriani* Clavareau is proposed for *M. suturalis; Myochrous brevicornis* is placed in *Glyptoscelis; M. denticollis* is not cited as West Indian.

Colaspis ebasi should read *Colaspis lebasi.*

The following species recorded from the West Indies, in many instances on excellent authority, are cited by Clavareau, in Coleopterorum Catalogus, pt. 59, only from the following localities but probably without the intention of discrediting the published records of West Indian occurrence: *Rhabdoptera picipes* (Olivier), Massachusetts to Dakota to Carolina; *Colaspis fastidiosa* (Lefevre), Colombia, Venezuela, Panama; *C. obscura* Fabricius, South America; *C. lebasi* Lefevre, Columbia, Central America; *C. femoralis* Lefevre, Columbia, Panama; *Typophorus viridicyaneus* (Crotch), Virginia to Nicaragua.

Cerotoma ruficornis (Olivier). Haiti (A. M. N. H.).

* *Cerotoma trifurcata* (Forster). Porto Rico (Van Zwaluwenburg).

Luperus placidus Suffrian. Grenada, Haiti (U. S. N. M.).

Malacosoma detritum (Fabricius). Montserrat (A. M. N. H.); Dominica (U. S. N. M.).

Diabrotica bivittata (Fabricius). Haiti (A. M. N. H.); Cuba (U. S. N. M.); Porto Rico (Gundlach, Jones).

Diabrotica graminea Baly. Cuba (A. M. N. H.); Vieques, Haiti (U. S. N. M.).

Diabrotica innuba (Fabricius). Culebra (U. S. N. M.).

Diabrotica melanocephala (Fabricius). Montserrat (U. S. N. M.).

Diabrotica ochreata (Fabricius). Montserrat (U. S. N. M.).

Diabrotica pulchella (Jacquelin Duval) is a *Phyllobrotica* (Schwarz).

Strike out *Hypolampsis nigrina* Clark, St. Paul's Island being not West Indian; also *Omototus fulvopubescens* Clark, the Cuban citation being erroneous.

Œdionychis cyanipennis (Fabricius). Haiti (A. M. N. H.).

Homophœta æquinoctialis (Fabricius). St. Croix (A. M. N. H.); Jamaica, Porto Rico, Antigua, treating *albicollis* as a synonym (U. S. N. M.).

* *Haltica subaurea* Suffrian. Cuba (U. S. N. M.).

* *Haltica ignita* Illiger? Bahamas (U. S. N. M.).

Epitrix fuscata (Jacquelin Duval). Porto Rico (Gundlach).

Epitrix parvula (Fabricius). Bahamas (U. S. N. M.).

* *Epitrix cucumeris* (Harris). Porto Rico (Jones, Van Zwaluwenburg). The identity of the Porto Rican insect with *E. cucumeris* of the United States is insisted upon by Mr. Schwarz, who made the identification.

Systena basalis Jacquelin Duval. Haiti (A. M. N. H.).

Lactica scutellaris (Olivier). Jamaica (A. M. N. H.).

Aphthona compressa (Suffrian). Haiti, Bahamas, Culebra (U. S. N. M.).

Aphthona maculipennis Jacoby. Porto Rico (U. S. N. M.).

Chætocnema apricaria (Suffrian). Jamaica, Vieques, Haiti (U. S. N. M.).

Homophyla krugi Weise. Guadeloupe (Fleutiaux).

Megistops granulatus Jacoby. Guadeloupe (U. S. N. M.).

Chalepus sanguinicollis (Linné). Vieques (U. S. N. M.); St. Thomas (A. M. N. H.).

Elytrogona bulla Boheman. Haiti (Spaeth).

Elytrogona quadrimaculata (Latreille), change to *E. quatrodecimmaculata* (Latreille).

Chelymorpha polysticha Boheman. Dominica (U. S. N. M.); St. Bartholomew (Spaeth).

Chelymorpha swarzi Thunberg change to *C. swartzii* Thunberg. See Schönherr, Syn. Ins., II, p. 229.

Omoplata distincta Boheman. Martinique (Spaeth).

* *Batonota rugosa* Wagener. Haiti (Mitt. Munch. Ent. Ver. V. 1881, p. 44).

* *Calaspidea grossa* (Linné). Jamaica (Spaeth).

* *Oxynodera variegata* (Linné). Antilles (Spaeth).

* *Physonota gigantea* Boheman. Antilles (Spaeth).

Strike out *Aspidomorpha bajula* Boheman, which according to Spaeth is a synonym of the East Indian *A. sanctæ crucis* (Fabricius).

A number of changes in position, etc., are proposed in Coleopterorum Catalogus, pt. 62, as follows: *Mesomphalia ænea* (Olivier) is placed in *Pseudomesomphalia* Spaeth; *M. exclamationis* (Linné) is placed in *Hilarocassis* Spaeth; *Chelymorpha angusticollis* Suffrian, *C. flavicollis* Boheman and *C. swartzii* Thunberg are placed in *Stoiba* Spaeth; *C. argus* (Lichtenstein) is treated as a variety of *C. cassidea* (Fabricius) and *C. polysticha* Boheman as a variety of *C. multipunctata* (Olivier). The other generic names under which Spaeth catalogues the species formerly placed in *Coptocycla* are not yet adopted by the authors.

Coptocycla bistripunctata Olivier. Antigua (U. S. N. M.). This name was probably cited in error by Fleutiaux and Sallé for *sexpunctata* Olivier.

* *Coptocycla propinqua* (Boheman). Haiti (A. M. N. H.).

Coptocycla subsignata (Boheman). Haiti, Porto Rico, Cuba (A. M. N. H.).

Coptocycla guttata (Olivier). Porto Rico (Van Zwaluwenburg, Jones); Cuba, Jamaica, Haiti (U. S. N. M.). (Champion, in Biologia).

* *Coptocycla guttata* var. *fuliginosa* (Olivier). Guadeloupe (Champion, in Biologia Cen. Am., Col., VI, pt. 2, pp. 194–195).

According to Champion, *l. c.*, *guttata* Boheman *nec* Olivier, 1808, and *hamulata* Boheman are synonyms of *signifera* (Herbst), but he appears to have overlooked the discrepancy between Olivier's original publication in 1790 and his later work (*Cf.* H. S. Barber, Proc. Ent. Soc. Washington, XVIII, 1916, pp. 117–118) by which *guttata* (Olivier) is validated.

Family LII. BRUCHIDÆ.

Bruchus chinensis (Linné). Porto Rico (Van Zwaluwenburg).

* *Bruchus amicus* Horn. Porto Rico (Van Zwaluwenburg).

* *Bruchus sallei* Sharp. Porto Rico (Van Zwaluwenburg).

Bruchus obtectus Say should be substituted for *B. obsoletus* Say, when that name is used for the bean weevil; add the locality Porto Rico (Van Zwaluwenburg).

Bruchus rufimanus, change author to Boheman.

Bruchus sinuatus Fåhraeus (*fide* Horn) is a variety of *B. quadrimaculatus* Fabricius.

Bruchus tetricus Gyllenhal. Cuba (U. S. N. M.).

* *Caryoborus nucleorum* (Fabricius). Cuba (U. S. N. M.).

Spermophagus hoffmanseggi Gyllenhal was proposed to replace *robiniæ* Olivier *nec* Fabricius. It is not equivalent to *robiniæ* Fabricius as we have it in the Preliminary List but to *robiniæ* erroneously cited in Olivier, Ent., IV, 1795, no. 79, p. 7, pl. 1, fig. 4 *a, b.*

Family LIII. TENEBRIONIDÆ.

By a regrettable error, the records for the genus *Cœlotaxis* derived from Guadelupe Island in the Pacific Ocean, were included in our Preliminary List. They should all be stricken out, as well as the record for *Conibius* on page 461.

Dacoderus dominicensis Horn. Cuba (U. S. N. M.).

* *Phaleria variabilis* Quedenfeldt. Porto Rico (Gundlach).

Strike out *Rhipidandrus micrographus,* as a misidentification of *Eutomus cornutus.*

Strike out *Cherostus* as synonymous with *Eutomus* and *C. jamaicensis* as synonymous with *E. cornutus.*

Change *Eutomus sulcatus* Gorham to *Rhipidandrus sulcatus* (Gorham). Numerous references to these genera are given in two papers: Proc. Ent. Soc. Washington, XV, 1913, pp. 188–193 and XVI, 1914, pp. 175–177. A letter from H. S. Barber states that he has recently examined larvæ of *Eutomus fulvomaculatus* (Dury) and *E. cornutus* (Arrow) and finds that they agree closely with the larvæ of *Eledona* and *Bolitotherus.*

Platydema antennatum Castelnau & Brullé. Haiti (U. S. N. M.).

Platydema apicale Castelnau & Brullé. Porto Rico (Gundlach).

* *Platydema picicorne* (Fabricius). Cuba, Haiti (U. S. N. M.).

* *Tribolium confusum* Jacquelin Duval. Porto Rico (Van Zwaluwenburg).

Tribolium ferrugineum (Fabricius). Porto Rico, Cuba (Gundlach).

Uloma retusa (Fabricius). Dominica (A. M. N. H.); Montserrat (U. S. N. M.).

* *Diaperis maculata* Olivier (*hydni* Fabricius). Porto Rico (Van Zwaluwenburg); Cuba (U. S. N. M.); Jamaica (Cockerell).

Change the authority for *Antimachus* to Gistel and the authority for *roudeni* to Fleutiaux and Sallé.

Alphitobius piceus (Olivier). Porto Rico (Gundlach).

* *Alphitobius diaperinus* (Panzer). Jamaica (Cockerell). Cosmopolitan.

* *Ulosonia biimpressa* (Latreille). Cuba (A. M. N. H.).

Zophobas morio (Fabricius). St. Thomas (Shoemaker); Porto Rico (Gundlach, Van Zwaluwenburg); Culebra (U. S. N. M.). Evidently widely distributed in West Indies. Compare also Ann. and Mag. Nat. Hist. 8th Ser., XIII, 1914, p. 487.

Cyrtosoma lherminieri (Chevrolat). Montserrat (U. S. N. M.); Dominica (A. M. N. H.).

Pyanisia undata (Fabricius). Cuba, Haiti (U. S. N. M.).

Pyanisia tristis Castelnau. Porto Rico (Gundlach).

Change *Rhacius sulcatus* Dejean to *Rhacius sulcatulus* Champion.

Family LIV. ALLECULIDÆ.

Allecula flavipes Jacquelin Duval. Bahamas (U. S. N. M.). The reference of West Indian species to *Allecula,* which is possibly an exclusively Old World genus, is questionable in the opinion of Mr. Schwarz; as is also the identification of *Isomera sericea* Say, which should perhaps read *I. valida* Schwarz, described from Florida.

Family LVI. MONOMMIDÆ.

Hyporhagus æneus Thomson. Cuba (U. S. N. M.). This species probably belongs to *Aspathines* Champion.

Hyporhagus marginatus (Fabricius). Bahamas (U. S. N. M.); Porto Rico (Gundlach).

Family LVII. MELANDRYIDÆ.

Definite records in this family are few. The single species mentioned in our Preliminary List may be more properly placed in Alleculidæ and, though we have information of species of *Orchesia, Canifa* and *Conomorphus* occurring in Cuba from Mr. Schwarz, not one of them has been described.

* *Phlœotrya mexicana* Champion is said to occur in Dominica (Ent. Mont. Mag., 1916, p. 37).

Family LIX. ŒDEMERIDÆ.

For *Nacerdes* Schmidt read *Nacerda* Stephens.

Copidita tenella Waterhouse. Haiti, Jamaica (U. S. N. M.).

Alloxacis dorsalis (Melsheimer). Cuba (A. M. N. H.).

Ananca vittata (Fabricius). Jamaica, Vieques, Cuba (U. S. N. M.).

S. Schenckling, in Coleopterorum Catalogus, part 65, makes some changes in this family by which the species *simplex* is transferred to *Copidita* and *dorsalis* to *Alloxacis*, etc.

Family LX. MORDELLIDÆ.

Mordella scutellaris Fabricius. Cuba (Gundlach).

Family LXI. PEDILIDÆ.

Change the spelling of *Macrataria* to *Macratria.*

Family LXII. ANTHICIDÆ.

* *Xylophilus* (*Hylophilus*) *halticioides* Champion. Grenada (Champion).

* *Xylophilus* (*Hylophilus*) *atomarioides* Champion. St. Vincent (Champion).

Family LXIV. MELOIDÆ.

Change the author of *Horia maculata* from Swederer to Swederus; the author of *H. auriculata* from Dugès to Champion; the name *Cantharis* to *Epicauta;* and *Nematognatha* to *Nemognatha.* (Schwarz.)

Horia maculata Swederus. Dominica (U. S. N. M.).

Tetraonyx 4-maculatus Fabricius. Montserrat (U. S. N. M.).

Epicauta annulicornis Chevrolat. Dominica (U. S. N. M.).

Family LXV. RHIPIPHORIDÆ.

Change *Rhipidophorus* to *Rhipiphorus* and transfer *sordidum* to *Macrosiagon.* (Schwarz.)

Macrosiagon basalis (Gerstaecker). Cuba (Gundlach).

Macrosiagon discicolle (Gerstaecker). Lesser Antilles (Gundlach).

Macrosiagon sordidum v. *major* (Quedenfeldt). Cuba (Gundlach).

* *Macrosiagon cruentum* (Germar). Cuba (A. M. N. H.).

Family LXVI. CURCULIONIDÆ.

The genus *Acamptopsis* is misplaced; it should follow *Cryptorhynchus.* (Schwarz.)

Change *Propodes* to *Prepodes.*

* *Pachnæus citri* Marshall. Jamaica.

* *Pachnæus marmoratus* Marshall. Jamaica.

Neocyphus pudens (Boheman). Montserrat (U. S. N. M.).

Diaprepes abbreviatus (Linné). St. Lucia (W. I. Bull.).

Diaprepes comma Boheman. Guadeloupe (Gundlach).

* *Diaprepes balloui* Marshall. Dominica.

* *Diaprepes famelicus barbadensis* Marshall. Barbados.

Lachnopus curvipes (Fabricius). Tortola (W. I. Bull.).

Lachnopus valgus (Fabricius). Anguilla (W. I. Bull.); Porto Rico (Gundlach).

Change *Tetrabothymus* to *Tetrabothynus.* (Schwarz.)

Anchonus suillus (Fabricius). Porto Rico (Gundlach).

* *Hypoptus insularis* Champion. Grenada, St. Vincent (Biologia C. Am. Col. IV, pt. 3, p. 302).

Change *Sternuchus* to *Sternechus.*

* *Sternechus pectoralis* Suffrian. Cuba (U. S. N. M.).

Sternechus vicinus Fleutiaux. Dominica (U. S. N. M.).

Change *Hiliplus* to *Heilipus.*

* *Heilipus elegans* Guerin. Jamaica (U. S. N. M.). (Introduced.)

Attelabus bipustulosus Jekel. Porto Rico (U. S. N. M.).

Strike out *Attelabus mutabilis* Jekel, the St. Paul locality being not West Indian; *A. foveipennis* Suffrian is also probably not West Indian.

Strike out *Ludovix* Castelnau and transfer the species *morio* Suffrian to *Erodiscus.*

Change *Botanobius* to *Botanebius.*

* *Anthonomus elegans* Leconte. Cuba (U. S. N. M.).

* *Anthonomus julichi* Dietz. Cuba (U. S. N. M.).

* *Anthonomus varipes* Jacquelin Duval. Cuba, Bahamas (U. S. N. M.). (Injurious to egg plant, Quaintance).

* *Derelomus albidus* Suffrian. Cuba (U. S. N. M.).

* *Analcis fulvicornis* Suffrian. Cuba (U. S. N. M.)

Polyderces zonatus change author to (Swederus) and add: Dominica (U. S. N. M.).

* *Conotrachelus coronatus* Leconte. Cuba (U. S. N. M.).

* *Conotrachelus lineola* Suffrian. Cuba (U. S. N. M.).

* *Conotrachelus presbyta* Suffrian. Cuba (U. S. N. M.).

* *Chalcodermus pupillatus* ? Suffrian. Cuba (U. S. N. M.).

* *Ulosomus furo* Suffrian. Cuba (U. S. N. M.).

* *Ulosomus laticaudis* Suffrian. Cuba (U. S. N. M.).

Euscepes porcellus Boheman has been redescribed by Leconte under the name *Acalles longulus* (Champion, Biol. Cent. Am., Col., IV, pt. 4, p. 496).

Cryptorhynchus batatæ Waterhouse. Porto Rico (Jones); Jamaica (U. S. N. M.); Grenada, St. Vincent, Antigua, St. Kitts, Nevis, Virgin Is. (W. I. Bull.). The larvæ of this species tunnel the sweet potato (Quaintance). It belongs to *Euscepes* and according to Faust, no true *Cryptorhynchus* occur in America except the introduced species *lapathi.*

* *Cryptorhynchus longus* (Leconte). Cuba (U. S. N. M.).

Pseudomus semicribratus Boheman. Haiti (U. S. N. M.). This genus seems to be peculiar to the West Indies, except that two or three species reach the U. S.

Styracopus phaseoli Marshall. Dominica, St. Vincent.

Macromerus lanipes (Olivier). Dominica (U. S. N. M.).

Trypetes guildini Fåhraeus. Dominica (U. S. N. M.).

Peridinetus maculatus Rosenschoeld. Porto Rico (Gundlach).

Peridinetus poeyi Jacquelin Duval. Porto Rico (U. S. N. M.). In this genus there may be some species synonymous with species described from South America.

* *Eurhinus festivus* (Fabricius). Haiti, Cuba (U. S. N. M.).

Baris tabaci (Sallé). Haiti (U. S. N. M.).

Cylas formicarius (Fabricius). Porto Rico (Van Zwaluwenburg, Jones). On sweet potato.

Apion portoricanum Gerstaecker is a synonym of *subæneum* Gerstaecker (Wagner, Mem. Soc. Belg., 1912, XIX, p. 36).

Family LXVII. BRENTHIDÆ.

Trachelizus linearis Suffrian. Porto Rico (Gundlach).

Belophorus maculatus (Olivier). Cuba (U. S. N. M.).

Belophorus militaris (Olivier). Porto Rico (Gundlach).

Rhaphidorrhynchus nitidicollis Gyllenhal. Dominica (U. S. N. M.).

Brenthus anchorago (Linné). Dominica, Montserrat (U. S. N. M.).

Brenthus turbatus Boheman. Haiti (U. S. N. M.); Porto Rico (Gundlach).

Family LXVIII. COSSONIDÆ.

Rhynchophorus palmarum (Linné), Martinique; the larvæ, locally called "grou-grou," are common in dead stems of *Areca* (Marshall).

* *Dynamis politus* (Gyllenhal). St. Vincent (Biologia).

Metamasius sericeus (Olivier). St. Kitts, St. Lucie (U. S. N. M.).

Sphenophorus liratus Gyllenhal. Dominica (A. M. N. H.); Martinique (Ann. Soc. Ent. Fr., VII, p. 447).

Sphenophorus quadrisignatus Gyllenhal. Dominica (A. M. N. H.).

Sphenophorus sordidus (Germar). Dominica (A. M. N. H.).

* *Sphenophorus sacchari* Gyllenhal. St. Kitts (Barber).

Sphenophorus longicollis (Olivier) to be dropped is a native of China, Ceylon, etc. (Ann. Soc. Ent. France, 1885, p. 288).

Calandra linearis (Herbst). Dominica (A. M. N. H.).

Calandra oryzae (Linné). Haiti, Mona (A. M. N. H.); Jamaica (Cockerell).

Cossonus impressus Boheman. Mona (A. M. N. H.).

The authority for *Cossonus hamiltoni* should be Slosson, not Champion.

For *Macrorhycolus* read *Macrorhyncolus*.

Family LXX. SCOLYTIDÆ.

The studies of Dr. A. D. Hopkins have made many changes necessary. The family name Scolytidæ is restored and many species names are added, though it may be that some of them are intended to represent taxonomic units, which may later be shown to constitute a smaller number of biological units. Assuming for the present that each represents a species, the following list of *Cryphalinæ* is to be substituted (*fide* Hopkins, Rept. 99) for that given in our Preliminary List.

Hypothenemus *Westwood.*

H. obscurus (Ferrari). Cuba.
H. lineatifrons Hopkins. Cuba.
H. sacchari Hopkins. Nevis.
H. parvus Hopkins. Cuba.
H. flavipes Hopkins. Cuba.
H. abdominalis Hopkins. Cuba.
H. brunneipennis Hopkins. Cuba.
H. amplipennis Hopkins. Cuba.
H. moschatæ (Schaufuss). Guadeloupe.
H. ceibæ Hopkins. Cuba.
H. pilosus Hopkins. Cuba.

Stephanoderes *Eichhoff.*

S. flavicollis Hopkins. Cuba.
S. elongatus Hopkins. Cuba.
S. unicolor Hopkins. Cuba.
S. subconcentralis Hopkins. Cuba.
S. gossypii Hopkins. Cuba.
S. depressus Eichhoff. Antilles.
S. opacifrons Hopkins. Porto Rico.
S. squamosus Hopkins. Cuba.
S. minutus Hopkins. Cuba.
S. nitidipennis Hopkins. Cuba.
S. nitidulus Hopkins. Cuba.
S. obliquus Hopkins. Cuba.
S. subopacicollis Hopkins. Cuba.
S. obesus Hopkins. Cuba.
S. setosus (Eichhoff). Guadeloupe.
S. cubensis Hopkins. Cuba.

Xylocleptes *Ferrari.*

X. carbonarius Ferrari. Cuba.
X. ? limbatus (Blandford). Cuba.

Coccotrypes *Eichhoff.*

C. ? robustus (Eichhoff). Cuba.
C. thrinacis Hopkins. Isles of Pines.
C. bakeri Hopkins. Cuba.
C. anonæ Hopkins. Cuba.
C. hubbardi Hopkins. Montserrat.

Theoborus *Hopkins.*

T. theobromæ Hopkins. Dominica.

Xyleborus *Eichhoff.*

X. inermis Eichhoff. Cuba.
X. sacchari Hopkins. St. Vincent.
X. affinis Eichhoff. Cuba.
X. grenadensis Hopkins. Grenada.

In addition, the following notes are derived from various sources: Kleine treats *Hypothenemus eruditus* Westwood and *plumeriæ* as identical; he also cites *Cryphalus mucronifer* Wollaston from St. Vincent.

Xyleborus ferrugineus (Fabricius). Porto Rico (Gundlach).

Xyleborus inermis Eichhoff. Cuba (Kleine); Porto Rico (Van Zwaluwenburg).

Xyleborus grenadensis Hopkins. Porto Rico (U. S. N. M.).

Xyleborus sacchari Hopkins. Porto Rico (U. S. N. M.).

Xyleborus perforans (Wollaston). St. Kitts, Barbados, St. Vincent (Barber); Jamaica (Cockerell).

It is to be noted that where these names are not repeated in Dr. Hopkins's list it is possible that the same insect is there recorded as a new species. Until his paper on Scolytid synonymy is published such matters can not be definitely treated.

Family LXXI. ANTHRIBIDÆ.

* *Aræcerus fasciculatus* (De Geer). Jamaica (Cockerell).

59.57.72M(81).

Article VI.— SECOND PAPER ON BRAZILIAN MUSCOIDEA COLLECTED BY HERBERT H. SMITH.

By Charles H. T. Townsend, Washington, D. C.

This paper is in continuation of Article II, Vol. XXXV, Bulletin of the American Museum of Natural History.

Dexosarcophaga, new genus.

Genotype: *Dexosarcophaga transita*, new species.

Differs from *Sarcophaga* as follows: Male. Vibrissal axis scarcely two-thirds of head-height, distinctly shorter than antennal axis. Clypeus but little depressed; epistoma wide, but little warped from plane of clypeus and only a little projected below vibrissal angles. Facialia showing distinct convexity. Proboscis much shortened. Vertex little over half eye-width, the front bulged in profile. Frontals not diverging except as they follow frontalia, stopping at base of antennæ. Outer verticals weakly developed. Parafacialia slightly over half as wide as clypeus, bare save row of hairs. Cheeks about one-third eye-length. Two weak discal scutellar pairs of bristles. Hind crossvein at about its own length from cubitus. Hind tibiæ not villous. No median marginals on second abdominal segment, weak marginal row on third and anal segments. Hypopygium small.

Dexosarcophaga transita, new species.

Length of body, 9.5 mm.; of wing, 7.5 mm. One male, Chapada.

Brownish; head silvery pollinose, frontalia brick-brown, palpi obscure rufous, antennae with rufous tinge. Thorax silvery-white pollinose; the three vittæ changeable from shining black to brown, the outer ones widened before suture, the middle one widened on scutellum. Abdomen with marked rufous tinge, the silvery-white pollen changing with light incidence, broken only by median black vitta and trace of one on each side. Legs brown. Wings nearly clear. Tegulæ subwatery-whitish.

Holotype, No. 24077 Am. Mus. Nat. Hist.

Amobiopsis ornata, new species.

Length of body, 8 mm.; of wing, 7 mm. One female, Chapada.

Differs from *aurata* Coq. as follows: Humeri, lateral thoracic stripes, pleuræ and mesoscutal pollen golden, pollen of head more deeply golden, cheeks more broadly golden. Abdominal segments four to six practically concolorous with rest of abdomen, not golden. Lateral triangles of abdomen blacker and more pronounced, the median vitta less so. No median marginals on segment one, those of other segments rather weaker. Legs darker brown.

Holotype, No. 24078 Am. Mus. Nat. Hist.

Paratheresia brasiliensis, new species.

Length of body, 9 to 11 mm.; of wing, 8.5 to 10.5 mm. Four females and one male, Chapada; one female, December.

Differs from *signifera* Towns. as follows: Parafacialia and parafrontalia silvery instead of golden. Frontalia rich light to dark velvet-brown, facial plate silvery. Antennæ blackish, first two joints obscurely reddish. Palpi pale fulvous. Pleuræ cinereous like rest of thorax. Abdomen largely rufous or brownish-red to brown. Legs brown.

Holotype, No. 24079 Am. Mus. N. H., female; allotype, male. Paratypes, No. 20954 U. S. Nat. Mus., female.

Euloewiopsis, new genus.

Genotype: *Euloewiopsis setosa* new species.

Female. Head characters approaching those of *Euloewia* and *Trixa*. Proboscis very short; palpi large, about as long as haustellum. Parafacialia as wide as clypeus, with row of strong bristles and microchaetæ outside them. Frontalia broad, widened anteriorly; course of frontal row curving inward, frontals stopping at base of antennæ. Vertex less than eye-width. Parafrontalia narrower than frontalia. No definite oral margin, the epistoma continuous with oral membrane below. Vibrissal angles far above level of lower profile of head. Differs from *Ennyomma* by four postsuturals, the two proclinate fronto-orbitals of female placed farther back, two pairs of discals on scutellum, no median macrochaetæ on second abdominal segment, abdomen pollinose, apical cell ending well before tip, third antennal joint nearly three times second, besides the above characters.

Euloewiopsis setosa, new species.

Length of body, 8 mm.; of wing, 7 mm. One female, Chapada.

Brown to black. Head brown, thinly pollinose. Antennæ and palpi bright orange. Frontalia and cheek grooves light brown. Thorax and scutellum dark brown, thinly silvery pollinose; leaving three wide black vittæ. Abdomen shining black, very thinly silvery pollinose showing most on bases of segments. Legs rufous-brown. Wings nearly clear. Tegulae white.

Holotype, No. 24080 Am. Mus. Nat. Hist.

Opsophasiopteryx, new genus.

Genotype: *Opsophasiopteryx mima*, new species.

Female. Differs from *Phasiopteryx* B. B. by the wide front, small apical decussate scutellar bristles and other characters given below, but counterfeits *P. bilimeki*

B. B. almost exactly in color even to the ocher-yellow antennæ. Differs from *Euphasiopteryx* T. by the stronger frontals and fronto-orbitals, the cheek grooves obliterating the bristly peristomal areas, parafacialia with microchaetæ, frontalia wider, three curved proclinate fronto-orbitals; larvipositor situated close to tip of venter, the abdomen not approaching that of *Oestrogaster* T.; cheeks not so bristled, front not swollen, antennæ inserted about on eye-middle. Integument is much more chitinized, even surpassing *Phasiopteryx* in that respect. Approaches *Phasiops* Coq. in several respects, but differs at once therefrom by lacking the facial carina.

Opsophasiopteryx mima, new species.

Length of body, 7.25 mm.; of wing, 6.75 mm. One female, Chapada.

Light clear brown, the head, sterna and femora shading to subrufous; thinly pollinose, showing on head as faintly brassy and on rest of body silvery. Antennæ bright orange-yellow, palpi pale fulvous, frontalia brick-brown. Four thoracic vittae left by pollen; the pollen of thorax and especially that of abdomen very thin. Wings slightly infuscate. Tegulæ well infuscated.

Holotype, No. 24081 Am. Mus. Nat. Hist.

Oestrogaster fumosus, Towns.

One female, Chapada. Appears indistinguishable from the holotype from the Rio Charape, Peru.

Oestrogastrodes similis, Towns.

One female, labeled " Piedra B " and probably meant for Piedra Branca, April. Appears to be the same form as the holotype from Panama.

Euscopoliopteryx, new genus.

Genotype: *Euscopoliopteryx nebulosa*, new species.

Venation and abdomen approximating in characters those of *Euscopolia* T.; head characters on plan of *Leskia*. The venation, while same vein pattern as in *Euscopolia*, differs as follows from that genus: Apical crossvein sinuate, placed well before point opposite end of second vein. Third vein ending in wing-tip. Petiole of apical cell longer than hind crossvein. Hind crossvein elongate, much longer than apical crossvein, subsinuate, about in middle between small crossvein and cubitus, approximated to hind margin of wing. Abdomen metallic, flattened, without macrochaetæ. Arista weakly plumose to tip. Head much flattened. Proboscis quite as long as head-height, palpi slender. Vertex about one-half of eye-width, the front equilateral and same width as vertex; face widening only a little from front. Parafrontalia, cheeks and especially parafacialia reduced almost to a line. Epistoma broadly bulged far below vibrissæ. Tegulæ large.

Euscopoliopteryx nebulosa, new species.

Length of body, 4 mm. (abdomen strongly recurvate); of wing, 4.3 mm. One male, probably River Cuyaba, January 23, 1886; no label on specimen, but pinned with cork and minute pin same as one labeled thus, and both minute pins corroded in very same manner. Evidently taken from a spider's web.

Head silvery. Frontalia brown. Antennæ flavous. Palpi fuscous. Thorax brown, silvery pollinose; three brown vittæ showing. Scutellum brown. Abdomen metallic green. Legs fulvous to pale brownish. Wings clouded on whole costal border, basal cells, the three crossveins, and tip of wing, with a spot in submarginal cell opposite hind crossvein and cloud of apical crossvein continued across same cell to costal cloud. All the clouds are more or less connected. Tegulæ watery-white.

Holotype, No. 24082 Am. Mus. Nat. Hist.

Trichinochæta, new genus.

Genotype: *Trichinochæta orbitalis*, new species.

Male. Facialia ciliate. Epistoma cut off. Arista long and hairlike, only slightly thicker on base than on middle, nearly half again as long as third antennal joint. Second antennal joint short; third very long, reaching almost to oral margin. Vertex but little over one-fifth head-width. One strong proclinate fronto-orbital; two reclinate, the hind one weak. Ocellars hairlike, vestigial. Facial depression deep, wide below; vibrissæ on oral margin. Outer vertical not developed. Proboscis short, palpi present. No discals on intermediate abdominal segments. Apical cell open, ending but slightly before extreme wing-tip. Cubitus rounded; hind crossvein straight, nearer to cubitus. Two sternopleurals. Frontals strong. Face receding in profile, lower border of head short. Eyes very thinly hairy, descending almost as low as end of antennæ.

Trichinochæta orbitalis, new species.

Length of body, 5.75 mm.; of wing, 5 mm. One male, Chapada.

Blackish. Head thickly bluish-silvery; frontalia brown; antennæ brownish to grayish, slightly rufous at base of third joint. Palpi obscurely rufous basally, broken off. Thorax and scutellum brown, thinly silvery; four thoracic vittæ. Abdomen shining black; bases of segments two to four narrowly silvery, widening on sides. Legs brown, tarsi darker. Wings narrowly infuscated along costa. Tegulæ subinfuscate, rather watery-whitish.

Holotype, No. 24083 Am. Mus. Nat. Hist.

Polygaster brasiliensis, new species.

Wulp's muscoid descriptions in the Biologia Centrali-Americana Diptera are almost hopelessly inadequate, due to his slight realization of the relative importance of characters in these flies. Yet I venture to identify the present species as his genus *Polygaster,* though it does not agree in certain important respects with the description and figures. It differs from the generic and specific descriptions of *P. egregia* Wp. as follows, including points not mentioned by Wulp.

Length of body, 9 to 10 mm.; of wing, 6 to 7 mm. Four males; two Rio Janeiro, July and August; two Chapada, one November.

Male. Front in middle over one-third head-width; face only slightly widened from front, but vertex narrowed. Frontals descending one bristle below base of antennæ. Two strong proclinate fronto-orbitals; two reclinate, the hind ones divaricate, the front ones decussate. Ocellars weak, almost hairlike. Parafacialia very narrowed below. Eyes and facialia bare. Arista very slender. Cheeks very narrow, the eyes descending little short of the vibrissal level. Proboscis very short. Vibrissæ porrect. Thorax narrowing behind suture. Scutellum with two laterals, the hind one nearly twice as long as the front one; a very weak apical decussate pair. Two sternopleurals, three postsuturals. First two abdominal segments with a lateral macrochaeta, second with median marginal pair, third and anal with marginal row. All macrochætæ strong, erect. Abdomen laterally compressed, especially behind, the hypopygial opening of anal segment showing as a narrow perpendicular slit within which the base of hypopygium can be indistinctly seen. First, third and fifth veins bristled; the first whole length, third nearly whole length, fifth nearly to hind crossvein. The bristling of the veins given is for the upper side of wing; on underside first vein is bristled only beyond end of auxiliary, third only at base, and fifth not at all. Apical cell open, ending very appreciably before exact wing-tip. Apical crossvein more or less bowed in, nearly parallel with hind margin of wing. Hind crossvein usually sinuate, less nearly parallel with hind margin.

Head, pleuræ and bases of last three abdominal segments thickly burnished silver-white pollinose; mesoscutum and scutellum less thickly so. Frontalia with rich gold-brown reflection in oblique view. First two antennal joints rufous; palpi flavous. Tibiæ more or less tinged with rufous.

Holotype, No. 24084 Am. Mus. Nat. Hist. Paratypes, 20955 U. S. Nat. Mus.

Parodomyia, new genus.

Genotype: *Parodomyia paradoxica,* new species.

Male. Looks like *Polygaster brasiliensis* Towns. in form and coloration. Differs from same in generic characters as follows: Front narrowed, vertex being about three-fourteenths of head-width. No proclinate fronto-orbitals; only one reclinate, decussate. Third antennal joint narrowed in middle, bulged apically, in profile. Arista plumose. Lateral scutellars more nearly equal, apical decussate pair moderately strong, discal pair present. Abdomen a little wider on base, not so compressed behind, first segment with some lateral discals. Wings broader; third vein bristled nearly to small crossvein, other veins bare. Strong costal spine. Cubitus angular; apical cell wider, ending a little farther before wing-tip. Parafacialia wider below, cheeks wider; outer vertical but little developed.

Parodomyia paradoxica, new species.

Length of body, 10 mm.; of wing, 8.5 mm. One male, Chapada, November.

Differs in coloration from *Polygaster brasiliensis* only as follows: Base of anal segment showing no silvery pollen, the entire segment being polished blackish-brown like the posterior half or so of preceding segment. Third antennal joint faintly rufous on base and tip. Palpi dark brown or blackish, the tips paler. Legs brown, the femora slightly reddish. Mesoscutum with four deep black vittæ, the inner ones narrow. Wings a little more infuscate on costa.

Holotype, No. 24085 Am. Mus. Nat. Hist.

Minthoplagia rafaeli, Towns.

Four males and four females, Chapada, three Nov. These appear to be the same form as the holotype from San Rafael, Jicaltepec, Veracruz. The sexes may be readily separated, aside from the hypopygial characters, on the third antennal joint, which is linear on front edge in female but strongly bulged in male. The male has same wide front and fronto-orbitals as female.

Eucelatoria australis aurescens, new subspecies.

Length of body, 6.5 to 8 mm.; of wing, 5.5 to 7 mm. Three males and two females, Chapada; one female, Corumba, May.

Differs from both *australis* Towns. and *armigera* Coq. as follows: Pollen of whole body strongly tinged with golden, the parafrontalia and mesoscutum especially brassy-golden. One of the males is without discals on the abdomen, showing the female sexual character in this respect; the same has been noted in *armigera*.

Holotype, No. 24086 Am. Mus. Nat. Hist., female; allotype, male. Paratypes, No. 20956 U. S. Nat. Mus., male and female.

Trochiloleskia, new genus.

Genotype: *Trochiloleskia flava*, new species.

Differs from *Leskia* and the other members of that group as follows: Proboscis almost three times head-height when extended, slender, bowed, nearly long enough to reach end of abdomen. First abdominal segment without median marginals in either sex, second segment with median marginal pair but lacking marginal row. Only two strong lateral scutellars; a very weak apical pair in both sexes, not decussate. Third antennal joint about three times second. Antennæ inserted above level of eye-middle. Arista very short-plumose. Cubitus rounded. Male hypopygium large.

Trochiloleskia flava, new species.

Length of body, 9.25 to 12.25 mm.; of wing, 8 to 10.5 mm.; haustellum reaching 6 mm. in length. One male and four females, Chapada, one female, January.

Flavous to fulvous. Head silvery-white, the parafrontalia faintly brassy. Frontalia, antennæ and palpi fulvous, third antennal joint more or less fuscous. Mesoscutum and scutellum pale golden pollinose, the usual four faint vittæ. Abdomen showing anal segment, hind edge and middle of third segment, and median vitta more or less deeply black; whole abdomen thinly silvery-white pollinose, showing best on anal segment and extreme bases of other segments. Legs fulvous. Wings clear. Tegulæ white to faintly watery-yellowish.

Holotype, No. 24087 Am. Mus. Nat. Hist., male; allotype, female. Paratypes, No. 20957 U. S. Nat. Mus., female.

Ommaleskia, new genus.

Genotype: *Ommaleskia fumosa*, new species.

Male. Differs from *Leskia* and allies as follows: — Eyes very large, descending far below level of vibrissæ and quite as far as level of oral margin, taking up nearly all of front and sides of head; the cheeks, front and face all extremely narrow. Parafacialia sublinear, narrowed almost to a line. Face widened evenly from front. Discals present on intermediate abdominal segments. Proboscis short. Arista pubescent. Third antennal joint narrow, three times second.

Ommaleskia fumosa, new species.

Length of body, 10 mm.; of wing, 8.75 mm. One male, Rio Janeiro, November.

Brown to blackish. Head silvery, including occiput. Frontalia brown. Antennæ fulvo-rufous. Palpi light yellow. Occipital beard white. Thorax silvery to pale brassy; leaving four heavy black vittæ, the inner ones a little narrower. Scutellum black, with pale brassy pollen apically. Abdomen rufous or rufo-fulvous on first two segments except the broad median blackish vitta, the rufous also including the last two segments except median vitta and hind borders black; segments silvery pollinose on base. Legs fulvo-rufous, the tarsi dark. Wings lightly infuscate. Tegulæ pale smoky-yellowish.

Holotype, No. 24088 Am. Mus. Nat. Hist.

The species seems to approach *Myobia flavicornis* Wp. from Teapa, Tabasco, judging from the description of latter.

Copecrypta ruficauda devia, new subspecies.

Length of body, 7 to 11 mm.; of wing, 5.5 to 9 mm. Sixteen males and fourteen females, all Chapada except two females Corumba, two males Piedra B, and one male Rio Janeiro; April, July and November.

Differs from *ruficauda* Wp. as follows: Haustellum distinctly longer. Anal segment only tipped with obscure reddish. Pollinose bands of abdominal segments much narrowed. Wings smoky on costal margin and along veins. Tegulæ tawny.

Holotype, No. 24089 Am. Mus. Nat. Hist., female; allotype, male. Paratypes, No. 20958 U. S. Nat. Mus., male and female.

Neoarchytas inambarica aurifrons, new subspecies.

Length of body, 7 to 12 mm.; of wing, 5.5 to 9 mm. Twenty-three males and five females, Chapada, nearly all November.

Differs from *inambarica* Towns. as follows: Parafrontalia of both sexes golden pollinose. Abdomen blackish, without the very decided purple luster of the typical form. Males occur with the abdomen wholly or nearly all black, and females with same red on sides; thus shifting the normal sexual coloration, which is just the opposite.

Holotype, No. 24090 Am. Mus. Nat. Hist., male; allotype, female. Paratypes, No. 20959 U. S. Nat. Mus., male and female.

Cyanopsis, new genus.

Genotype: *Cyanopsis costalis*, new species.

Allied to *Copecrypta*, but basal aristal joints short and third antennal joint not unusually widened. Form of body rather narrowed. Strong ocellars and one faciorbital present. No palpi. Frontals of male in single row; female with two proclinate fronto-orbitals, male with none. Second antennal joint elongate, third a little wider and not twice second joint in either sex. Male vertex about one-fourth head-width. Strong erect median marginals on second abdominal segment; no discals on intermediate segments in either sex. Venation of *Neoarchytas*. Wings broad, especially in male. Third vein bristled half-way or more to small crossvein.

Cyanopsis costalis, new species.

Length of body, 8.5 to 10 mm.; of wing, 8 to 9.5 mm. One male and one female, Chapada, November.

Metallic bluish or greenish-black, polished. Head silvery-white; parafrontalia dark, with thin brassy pollen. Frontalia and antennæ subfulvous, third antennal joint and arista more or less blackish. Thorax greenish-black, brassy pollinose; leaving three vittæ on each side, the two inner ones narrower. Pleuræ and scutellum brassy pollinose. Abdomen cyaneous, showing mahogany colored on sides and below in both sexes, as well as extreme tip, and slightly so on tergum in female. Legs brown. Wings clear, the costa narrowly infuscate. Tegulae white. In very oblique view, the abdomen shows brassy pollen on base of second segment.

Holotype, No. 24091 Am. Mus. Nat. Hist., male; allotype, female.

Diaphanomyia, new genus.

Genotype: *Diaphanomyia aurea*, new species.

Male. Differs from generic description of *Paragymnomma diaphana* B. B. as follows: Arista only microscopically-pubescent, the second joint about three times as long as wide. Abdomen oval, swollen; with macrochætæ on front, middle and back of anal segment in three irregular rows; on hind margin of third segment in row, with a discal pair; only median marginal pair on second segment, with one at each side; no median on first segment. Cubitus small V-like, with short stump. Macrochætæ of anal segment not mixed with long hairs.

Diaphanomyia aurea, new species.

Length of body, 7 to 8 mm.; of wing, 6.5 to 7.5 mm. Two males, Chapada, January and November.

Differs from color description of *Paragymnomma diaphana* only as follows: Wings pale infuscate, darker along costa. Pile of parafacialia and cheeks pale golden-yellow, that of parafrontalia black. Parafrontalia, mesoscutum and scutellum with bright golden pollen.

Holotype, No. 24092 Am. Mus. Nat. Hist. Paratype, No. 20960 U. S. Nat. Mus.

Adejeania brasiliensis R. D.

One male, Chapada. This species differs from *armata* Wied. as follows: Antennæ smoky-rufous to blackish. Face and front fulvo-flavous in ground color, the face silvery, the parafrontalia brassy. No black dots on median line of abdomen. Legs without black. No median marginal spines on first segment, or at most a vestigial one or two. A male and a female, from the Rio Charape, Peru, about 4000 feet, collected by myself, agree in the above characters with the Chapada specimen.

Atactopsis, new genus.

Genotype: *Atactopsis facialis*, new species.

Differs from *Atactomima* Towns. as follows: Male. Head not so enlarged, not wider than thorax. Vertex about or a little over one-fifth head-width. One strong reclinate fronto-orbital. Parafacialia with row of weak bristles meeting frontals, bare inside same but with row or so of hairs outside. Three postsuturals.

Atactopsis facialis, new species.

Length of body, 7 mm.; of wing, 6.5 mm. Two males, Chapada.

Blackish. Head pale brassy pollinose, the facial plate more silvery, the dark of parafrontalia giving a greenish-yellow effect. Frontalia pale brown. Third antennal joint and arista blackish, first two antennal joints light rufous. Palpi fulvous. Humeri silvery pollinose, extending posteriorly in stripe. Pleuræ brassy. Four equal black thoracic vittæ, with silvery vittæ between them. Scutellum brownish-rufous except base. Abdomen subshining, showing yellowish-silvery pollen in varying lights. Anal segment rather more brassy, tip rufous. Legs blackish. Wings clear. Tegulæ whitish.

Holotype, No. 24093 Am. Mus. Nat. Hist. Paratype, No. 20961 U. S. Nat. Mus.

Paratactopsis, new genus.

Genotype: *Paratactopsis setosa*, new species.

Male. Vibrissal axis hardly half head-height, a little less than antennal axis. Clypeus moderately broad, elongate, only slightly sunken; epistoma very broadly projected far below vibrissæ. Facialia much flattened, over half as wide as clypeus, sparsely set with stout bristles nearly half way up. Proboscis little over half head-height, palpi stout clubshaped. Second antennal joint elongate, third about one and one-half times second. Arista slender, bare, basal joints short. Eyes bare. Front widening from vertex, which is little over half eye-width. Frontals diverging in wide curve, descending about three bristles below base of antennæ. Outer verticals absent. One reclinate, no proclinate fronto-orbitals. Frontalia narrowed posteriorly, wider in middle than one parafrontal. Ocellars not developed. Parafacialia a little over half as wide as clypeus, with a sparse row of short macrochætæ nearly in line with frontals and hairlike microchætæ outside them. Cheeks rather over two-fifths eye-length. Five strong sternopleurals, with several weak additional bristles. Four postsuturals, three preacrostichals, four postacrostichals, all strong. Four strong lateral scutellars, one strong discal pair, one very weak apical pair. Apical cell widely open a little before tip. Cubitus rounded, without wrinkle. Hind tibiæ ciliate. Claws elongate. Abdomen very short-oval, almost round in outline from above. No median macrochætæ on first two abdominal segments, only marginal row on third; anal segment with weak marginal, submarginal and discal sparsely placed. Hypopygium small, in posteroventral slit, with ventral exposure.

Paratactopsis setosa, new species.

Length of body, 9 mm.; of wing, 8.5 mm. One male, Chapada, November.

Black, more or less shining, only thinly pollinose. Head lighter, yellowish. Frontalia pale brownish-rufous. Antennæ pale rufous. Palpi fulvous. Facial plate and facialia silvery pollinose. Parafrontalia blackish, with thin coat of pollen. Parafacialia and cheeks pale brassy pollinose, extending upward on each side of frontalia. Occiput more ashy, the beard gray. Thorax and scutellum with faint purplish reflection, very thinly silvery pollinose; leaving four narrow even black vittæ. Abdomen black, the silvery pollen showing most on extreme bases of intermediate segments; anal segment thinly pollinose. Legs reddish-brown. Wings clear, infuscate on base. Tegulæ pale fuscous.

Holotype, No. 24094 Am. Mus. Nat. Hist.

Thysanopsis, new genus.

Genotype: *Thysanopsis albicauda*, new species.

Differs from *Thysanomyia* B. B. as follows: Male with usually two rows of frontals on each side. Only one reclinate fronto-orbital. Second antennal joint elongate, the third rather heavy and scarcely over twice second. Hind tibiæ thickly long-ciliate. Differs from *Parachæta* Coq. in having bristles of facialia in irregular double row, not single; front and cheeks puffed or swollen out; vibrissæ well above oral margin. The female possesses the median marginal pair of macrochætæ on second abdominal segment.

Thysanopsis albicauda, new species.

Length of body, 11 to 14 mm.; of wing, 9 to 11 mm. Twelve males and ten females, one Abrilongo, January; the rest Chapada, one January and most of the others November.

Black. Head silvery-whitish, frontalia dark brown; antennæ and palpi brown, the first two antennal joints and tips of palpi lighter. Thorax thinly silvery, leaving four narrow vittæ; scutellum usually with gold-brown pollen, which is also to be seen on extreme bases of the second and third abdominal segments, but some specimens show same silvery. Anal segment wholly thickly silvery-white pollinose above and below. Abdomen showing slight rufous tinge on sides in male. Wings clear except the fuscous costo-basal area. Tegulæ wholly fuscous.

Holotype, No. 24095 Am. Mus. Nat. Hist., male; allotype, female. Paratypes, No. 20962 U. S. Nat. Mus., male and female.

Zygosturmia protoparcis meridionalis, new subspecies.

Length of body, 8 to 10 mm.; of wing, 6.5 to 8.5 mm. Five males and one female, Chapada, two November; one male, Abrilongo, January.

Differs from *protoparcis* Towns. as follows: Male parafrontalia, parafacialia, cheeks and occipital orbits deep golden pollinose. Female parafacialia with only a faint tinge of golden, but parafrontalia deep golden.

Holotype, No. 24096 Am. Mus. Nat. Hist., male; allotype, female. Paratypes, No. 20963 U. S. Nat. Mus., male.

Tachina distincta Wied. does not appear to me to belong to this genus.

Ypophæmyia malacosomæ brasiliensis, new subspecies.

Length of body, 6.5 mm.; of wing, 4.75 mm. One male, Corumba, May.

Differs from *malacosomæ* Towns. as follows: First two antennal joints reddish-yellow. Legs chestnut-brown to black.

Holotype, No. 24097 Am. Mus. Nat. Hist.

This genus is extremely similar to both *Achætoneura* B. B. and *Masiceropsis* T. It differs from the former by the deeper facial depression, broader front, and the shorter, stouter, stiff and porrect arista; from the latter by the aristal characters, certain venational peculiarities, pectinate hind tibiæ, and strong outer vertical in male. It is even more closely related with *Parafrontina* B. B., but the latter is at once distinguished from the other three by its thickly pilose eyes.

Cylindromasicera prima Towns.

One male and one female, Chapada, the female Nov.; one female, Rio Janeiro, August. These appear the same form as the holotype from Sullana, in the coast region of northern Peru.

Paraphasiopsis, new genus.

Genotype: *Paraphasiopsis mellicornis*, new species.

Differs from *Phasiopsis* Towns. as follows: Male. Palpi absent, represented by the most microscopic tubercles only. Vertex not as wide as eye. Ocellars present. Two reclinate fronto-orbitals. Outer vertical developed, but short. Epistoma about as wide as cheeks. Frontalia scarcely over one-third width of one parafrontal. Proboscis much longer than head-height. Two sternopleurals, with a weak additional bristle. No discal row on anal segment. Male claws extraordinarily elongate.

Paraphasiopsis mellicornis, new species.

Length of body, 9.5 mm.; of wing, 7.5 mm. One male, Chapada.

Chestnut-brown. Head light, silvery-white pollinose, the pollen with faint yellowish reflections. Occiput more ashy. Antennæ clear honey-yellow. Arista and frontalia brown. Thorax, scutellum and abdomen thinly silvery-ashy pollinose; four black vittæ on thorax. Scutellum fulvous on margin. Hypopygium and tip of anal segment rufous. Wings clear. Tegulæ whitish, with yellow borders.

Holotype, No. 24098 Am. Mus. Nat. Hist.

Syringosoma, new genus.

Genotype: *Syringosoma pennipes*, new species.

Habitus and characters of *Homogenia* Wulp, but abdomen very narrow and subtubular. The abdomen is narrowed just behind base, and is only slightly widened apically. Wings narrow; apical cell closed. There are true short macrochætæ on margins of abdominal segments. The fifth visible abdominal segment, or first hypopygial, is furnished with microchætæ and macrochætæ. Hind tibiæ well ciliate.

Male. Vertex scarcely one-fourth head-width. Frontalia filling whole front at vertex. Third antennal joint broad and short, vibrissæ high above oral margin, as in *Homogenia,* and with the peculiar posteriorly-widened tegulæ of that genus. Differs at once from *Cylindrophasia* Towns. in the antennæ and first hypopygial segment. Female not known.

Syringosoma pennipes, new species.

Length of body, 12 mm.; of wing, 10 mm. One male, Benevides, July.

Fulvous to rufous. Practically same coloration as *Homogenia latipennis* Wp., even to wings and tegulæ, and including the mesoscutal pattern, only the golden pollen more deeply golden. Wings smoky on extreme base, as well as broadly on tip, the intervening space yellowish. Tarsi and apical half of tibiæ blackish. Tergum of abdomen showing very pale brownish in broad triangles.

Holotype, No. 24099 Am. Mus. Nat. Hist.

Xanthomelanopsis brasiliensis, new species.

Length of body, 6 mm.; of wing, 6 mm. One female, Benevides, July.

Differs from *peruana* Towns. as follows: Parafacialia and parafrontalia extremely narrow, reduced almost to a line. Frontalia very wide. Third antennal joint about twice second. Squamæ black except the part covered by the squamulæ. Abdomen black on apical half, the black sending a median vitta forward on tergum. Head thinly silvery pollinose. Mesoscutum black, with silver fascia in front of suture and another on hind edge. No thoracic vittæ. Scutellum black. Palpi and bases of femora rufous.

Holotype, No. 24100 Am. Mus. Nat. Hist.

The species is, at best, an atypical member of the genus.

59.57.99A(67.5)

Article VII.— NEW SPECIES OF BEES OF THE GENUS ANDRENA, FROM EQUATORIAL AFRICA, IN THE AMERICAN MUSEUM OF NATURAL HISTORY.

By Henry L. Viereck, Washington, D. C.

The following descriptions are based on two of the three species of *Andrena* known from Equatorial Africa, the other being *Andrena africana* Friese, collected by Sjostedt's Kilimandjaro Expedition.

Andrena (**Andrena**) **æquatorialis**, new species.

Type.— American Museum of Natural History, New York, N. Y.

Type locality.— Boga, (1° N., 30° E.; Boom.), Eastern Belgian Congo; July, 1914 (J. Bequaert).

Related to *A.* (*A*) *helvola* Linnæus and may prove to be a race of *Andrena africana* Friese.

Female.— Length 9 mm.; body black, mostly covered with pale ochreous hairs; head with its facial line : transfacial line :: 62 : 80; axial line : temporal line :: 34 : 21; malar line : joint 3 of antennæ :: 1 : 10; ocelloccipital line : greatest diameter of lateral ocellus :: 7 : 5; elevated portion of malar space virtually wanting; head covered with pale ochreous hairs except on the vertex and in the foveæ; front rather distinctly, longitudinally striate, not elevated into a welt along the fovea; fovea at most : ocellocular line :: 14 : 16; foveal band wanting at upper end of the inner eye margin; distance between fovea and ocelli : ocellocular line :: 2 : 16; fovea somewhat attenuated below its middle to a plane apparently a little below the clypeal line, fovea filled with dark seal brown hairs except below its middle where the hairs are pale golden, fovarea wanting; vertex and temples along the upper edge of the eye with blackish hairs; face shiny, indistinctly reticulate, with well defined punctures that are one or two puncture widths apart; clypeus slightly elevated above the apical margin, slightly convex, sculptured like the face except that the punctures are larger and mostly adjoining, clypearea wanting, clypeus very hairy, its sculpture nearly hidden by hairs; labrarea slightly subemarginate, nearly truncate, its width at base : length down the middle :: 13 : 6; width at apex : length down the middle :: 6.5 : 6; labrarea at base : width of labrum :: 13 : 23, the latter with a fringe of golden hairs; labrum apparently without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennæ : joints 4+5 :: 10 : 8; joints 4 and 5 thicker than long, the succeeding joints as thick as long or a little longer than thick except joints 11 and 12 which are distinctly longer than thick; antennæ blackish excepting joints 5 and following joints which are reddish beneath; mandibles typical, robust, extending to a little beyond the outer edge of the labrum, black except for the apical third which is very dark reddish; palpi typical; thorax covered with an abundance of pale ochreous hairs which are as long as the dorsulum where they are darker, almost tawny, than the pale hairs on the mesopleuræ; dorsulum dullish, finely reticulated and punctured like the face but not so deeply or closely; notauli represented by a shiny line; mesopleuræ sculptured somewhat like the dorsulum but more closely and less distinctly punctured, scutel hairy and sculptured much like the dorsulum, except that the punctures are sparser and the interstices smoother; metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and less distinct; tegulæ dark brown, shiny; wing base partly blackish brown, subcosta blackish brown, stigma reddish brown, rest of veins dull brownish stramineous, first recurrent vein received by the second submarginal cell a little before the middle and distinctly nearer to the first transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus almost interstitial and forming a nearly acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown; legs blackish except for the small joints of the tarsi which are more or less dark brown, legs covered with brownish and ochreous hairs; scopa typical, its hairs reddish except the hairs at base above which are decidedly blackish brown; hind metatarsi at most apparently a little narrower than mid metatarsi; propodeum with its enclosure poorly defined, with a loose network of fine carinæ, dullish and finely reticulated, rest of upper face of propodeum sculptured somewhat like the dorsulum but with less distinct punctures, and covered with longer tawny hair, propodeal pleuræ with sparse shallow punctures and almost hidden by the pale tawny floccus; abdomen with its tergum shiny and sculptured much like the face but with shallow, sparser punctures, the punctures from two to six or more puncture widths apart on the first tergite, the punctures apparently closer on the succeeding tergites, first, second, third, and fourth tergites with an entire apical, ochreous hair band, apical edge of first, second, third, and fourth tergites with a stramineous border; second tergite with its elevated portion down the middle : depressed portion :: 15 : 11; fifth tergite shiny, indistinctly reticulate, its punctures coarser and closer together than on the other tergites; pygidium nearly planate, with a shallow furrow on each side, nearly pointed at apex; tergum with conspicuous, pale nearly erect ochreous hairs, in addition to the hair bands with an admixture of black hairs on the fourth; fimbria blackish.

Andrena (Andrena) boswendica, new species.

Type.— American Museum of Natural History, New York, N. Y.

Type-locality.— Boswenda (1° 20′ S., 29° 20′ E.; 1900 m.), Eastern Belgian Congo; October 22, 1914. At flowers of *Ranunculus pubescens* and *Geranium aculedatum* (J. Bequaert).

Apparently not related to any *Andrena* treated in Schmiedeknecht's Apidæ Europææ.

Female.— Length 10 mm.; body black, mostly covered with pale ochreous almost whitish hairs; head with its facial line : transfacial line :: 73 : 89; axial line : temporal line :: 37 : 20; malar line : joint 3 of antennæ :: 15 : 13; ocelloccipital line : greatest diameter of lateral ocellus :: 10 : 5; elevated portion of malar space nearly as long as depressed portion; head covered with pale ochreous hairs except on the vertex where the hairs are dark brown or brownish; front rather distinctly, longitudinally striatopunctate, not elevated into a welt along the fovea; fovea at most : ocellocular line :: 11 : 17; foveal band represented at upper end of the inner eye margin by a beveled space adjoining the eye; distance between fovea and ocelli : ocellocular line :: 5 : 17; fovea somewhat attenuated below its middle where it is apparently only a little narrower than the greatest width of the fovea, the latter continued to a point apparently distinctly below the clypeal line; upper third of fovea filled with dull brownish hairs, the lower two-thirds mostly with pale ochreous hairs; fovarea wanting; temples along the upper edge of the eye with brownish hairs, face mostly dullish, finely reticulate, with rather distinct punctures that are from adjoining to as many as two puncture widths apart; clypeus distinctly elevated above the apical margin, slightly convex, sculptured like the face except that the punctures are larger closer and better defined; clypearea present but poorly defined except on the lower fourth where it is a median polished welt; clypeus thinly hairy, its sculpture not at all hidden by hairs; labrarea truncate, its width at base : length down the middle :: 14 : 5.5; width at apex : length down the middle :: 7 : 5.5; labrarea at base presumably nearly half as wide as the labrum, the latter with a fringe of golden hairs, labrum apparently without a median longitudinal crista between the labrarea and apical edge of labrum; joint 3 of antennæ : joints 4+5 :: 13 : 9; joints 4 and 5 thicker than long, the succeeding joints apparently as thick as long or a little longer than thick, except joints 11 and 12 which are apparently distinctly longer than thick; antennæ blackish throughout except the apical joint which is brownish at tip and beneath; mandibles typical, robust, extending a little beyond the lower angle of the clypeus, black except for the apical third which is dark reddish; palpi nearly typical; thorax covered with an abundance of pale ochreous almost whitish hairs which are nearly as long on the dorsulum where they are darker, i. e., from tawney to dark brown, than the almost whitish hairs on the mesopleuræ; dorsulum dullish, finely reticulated and punctured much like the clypeus but not so closely; notauli represented by a shining line; mesopleuræ sculptured somewhat like the dorsulum but not so distinctly, scutel hairy and sculptured much like the dorsulum, metanotum with pale tawny hair and densely sculptured; tegulæ blackish except for a dark brown shiny reticulated area; wing base partly blackish brown, subcosta blackish brown, stigma dark reddish brown with a blackish border, rest of veins brown with a blackish tinge, first recurrent vein received by the second submarginal cell before the middle and nearer to the first transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly strongly tinged with brown; legs blackish except for the small joints of the tarsi which are more or less pale brown, legs covered with brownish golden and ochreous hairs; scopa typical, its hairs uniformly golden with a reddish brown tinge except at base above where they are decidedly darkened; hind metatarsi at most apparently a little narrower than mid metatarsi; propodeum with its enclosure rather well defined, dullish and finely reticulated besides having a loose network of fine carinæ, rest of upper face of propodeum sculptured somewhat like the metanotum but not so densely, and covered with finer pale tawny hair, propodeal pleuræ finely reticulated and with sparse shallow punctures and almost hidden by the pale ochreous floccus; abdomen with its tergum shining and sculptured much like the face, the punctures from adjoining to three or four puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites but smaller on the third and fourth; first, second, third, and fourth tergites with an apical, rather thin, pale ochreous hair band that is not interrupted in the middle; apical edge of first, second, third, and fourth tergites with a brownish-stramineous border; second tergite with its elevated portion down the middle : depressed portion :: 16 : 12; fifth tergite shining, reticulate, its punctures coarser than on the preceding tergite; pygidium nearly planate, convex near apex, with a shallow furrow on each side, nearly pointed at apex, mostly blackish, reddish brown at base; tergum with inconspicuous, pale nearly erect hairs in addition to the hair bands, fimbria blackish brown, third and fourth tergites with blackish brown hairs.

Allotopotype.— American Museum of Natural History, New York, N. Y.

Data the same as for the type.

Apparently related to *Andrena soror* Dours judging from Schmiedeknecht's report[1] on this species.

Male.— Length 9 mm.; body black, mostly covered with pale ochreous almost white hair; head with its facial line : transfacial line :: 62 : 79; axial line : temporal line :: 34 : 22; temples hardly produced, trapezoidal, the broadest part above the middle of the eye; malar line : joint 3 of antennæ :: 15 : 11; depressed portion of malar space virtually wanting; hairs between the upper ends of the eyes rather brownish; front sculptured as in the female; ocellocular line : ocelloccipital line :: 17 : 8.5; face sculptured as in the female; clypeus slightly convex, more shining and more distinctly punctured than the face, somewhat elevated directly above the apical margin; clypearea present on the lower fourth of the clypeus; sculpture of the clypeus not hidden by the moustache; labrarea with a broad rounded shallow emargination, almost truncate, polished, its width at base : greatest length :: 13 : 5, width at apex : length down the middle :: 9 : 4; labrarea at base at least half as wide as the labrum, the latter with a fringe of pale golden hairs; joint 3 of antennæ : joint 4 :: 11 : 6; joint 4 a little thicker than long, following joints from a little longer than thick to one and one-half times as long as thick, dullish, flagel, undulate in outline; antennæ blackish throughout; mandibles atypical, rather robust, extending a little beyond the outer edge of the labrum and approximately to the middle of its fellow, black except for the apical fourth which is more or less dark reddish; palpi nearly typical; thorax covered with an abundance of pale ochreous almost white hairs, hairs of dorsulum seemingly shorter than hair of mesopleuræ; dorsulum dullish, finely reticulated and sparsely punctured, the punctures shallow and from adjoining to three puncture widths apart, mostly one or two puncture widths apart; notauli represented by a shining line; mesopleuræ dullish with pale ochreous hairs throughout, finely reticulated and mostly covered with shallow pits, that are mostly two to three pit widths apart; scutel hairy and sculptured like the dorsulum; metanotum hairy like the dorsulum, densely sculptured; tegulæ blackish with brownish tips, shiny and finely reticulated, partly almost polished; wing base mostly blackish brown, subcosta blackish, stigma dark reddish brown with a blackish border on its lower side, first recurrent vein received by the second submarginal cell beyond the middle but not quite as near to the second transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial, forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown; legs blackish brown excepting the small joints of the tarsi which are rather dark brownish; legs covered with pale ochreous hairs, except on the tibiæ and tarsi which are more or less covered with pale brownish hairs; hind metatarsi at most hardly wider than mid metatarsi and nearly half as wide as hind tibiæ at apex of the latter; propodeum with its enclosure poorly defined, the enclosure mostly granular, with a finely rugulose, central, shallow impression, rest of upper face sculptured somewhat like the mesopleuræ, covered with pale ochreous hair; propodeal pleuræ sculptured as in the female, the sculpture nearly hidden by the uniformly distributed pale ochreous hairs; abdomen with its tergum shiny, finely reticulated and rather distinctly punctured, the punctures mostly two or three puncture widths apart; first, second, third, and fourth tergites with pale ochreous erect hairs, except on the apical margins where the hairs are nearly appressed and arranged in bands; second tergite with its elevated portion down the middle: depressed portion :: 17 : 9; fifth tergite with its basal blackish portion covered with poorly defined punctures that are as many as four puncture widths apart, rest of fifth tergite and exposed portion of sixth and seventh tergites with a stramineous margin, anal process narrow, with a subapical transverse carina, nearly triangular at apex, and with a brownish stramineous margin; fifth tergite with brownish hairs except for an apical fringe of pale hairs, hair at apex of abdomen of a brownish hue.

---

[1] Apidæ Europææ.

59.57,99P

Article VIII.— CONTRIBUTIONS TO OUR KNOWLEDGE OF THE BEE GENUS *PERDITA* SMITH.

By Henry L. Viereck, Washington, D. C.

Perdita Smith.

1853 Cat. Hym. Brit. Mus., Vol. I (128), pl. 5, figs. 10–14.
Genotype.— *P. halictoides* Smith. (Monobasic).

During the past year this genotype was taken in and near Washington, D. C., at flowers of *Chrysopsis mariana* as follows: Kalmia Road, D. C., September 9, and Hyattsville, Md., Sept. 24 (H. L. Viereck); Chesapeake Beach, Md., Sept. 24 (W. L. McAtee). A specimen from Millville, N. J., Oct. 6, 1916 (E. R. Kalmbach) without a flower record is also before me. Two years earlier (Sept. 17, 1914) Mr. R. C. Shannon rediscovered the species at Chesapeake Beach (without a flower record).

P. (**Alloperdita**) **novæangliæ** Viereck, new subgenus.

Differs from *Perdita* s. s. in the elongate head, toothed claws and in having three submarginal cells.

Beltsville, Md., July 9, 1916, at flowers of *Xolisma ligustrina* (W. L. McAtee).

P. (**Cockerellia**) **bequærti**, new species.

Type.— American Museum of Natural History, New York, N. Y.

Type locality.— Ramsey, New Jersey, September 4, 1916, at flowers of *Helianthus giganteus* (J. Bequaert).

Judging from Prof. Cockerell's key to *Perdita*,[1] this species has characters in common with *P. sparsa* Fox, although in structure it is manifestly closely related to *P.* (*C.*) *albipennis* Cresson.

Female.— Length 7.5 mm. Color — Hairs whitish except as mentioned below; head, thorax and propodeum mostly greenish with yellow maculæ; clypeus medially with coppery tinge, its apical margin brownish, with a subapical greenish yellow band that is prolonged toward the base of the clypeus as an acute angle; lateral face marks greenish yellow, spatulate; scape yellowish except for the posterior aspect which is blackish, rest of antennæ blackish except the tip of the last joint which is pale; mandibles reddish brown to dull stramineous; pronotum with a yellow border along the hind edge, sides of the pronotum with a yellow marginal mark, tubercles with a broad yellow border along the upper edge, anterior half of tegulæ mostly dark brown, rest of tegulæ pale brownish stramineous; legs blackish brown except fore and mid knees and a stripe on the anterior aspect of the fore tibiæ which are yellowish, with pale hairs that are tinged with brown like the hairs of the vertex and dorsulum; wings tinged with brown, subcosta blackish brown, rest of veins including the margin of the stigma pale brown, stigma pale yellowish brown; abdomen blackish brown with a yellowish spot on each side of the first tergite and a basal yellow band on each of the following tergites except the pygidium, the bands of the second and third tergites narrowly interrupted in the middle, the bands of the second and third tergites prolonged backward along the lateral margin, the yellow margin of the second tergite almost divided by the marginal longitudinal fovea. Head with its facial line: transfacial line :: 39 : 44.5; axial line : temporal line :: 22 : 12; elevated portion of malar space virtually wanting; malar line : joint 3 of antennæ :: 2.5 : 4; ocelloccipital line : greatest diameter of lateral ocellus :: 7 : 3; front finely reticulated and with sparse shallow punctures; greatest width of fovea : ocellocular line :: 2 : 8; distance between fovea and eye : greatest width of fovea :: 1 : 2; distance between fovea and ocelli : ocellocular line :: 6 : 8; fovea attenuated below and ending at a point apparently opposite the center of the antennal foramen; lateral face marks polished, sparsely punctured; clypeus polished, more sparsely punctured than the lateral face marks; labrum blackish brown, nearly quadrate, impunctate on the basal half down the middle, coarsely and sparsely punctured on each side of the impunctate space; apical half finely and coarsely punctured; joint 3 of antennæ : joint 4 :: 5 : 3.5; joints 4 to 6 apparently nearly as thick as long, the following joints apparently more or less longer than thick, the end joint nearly twice as long as thick; mandibles atypical, the lower edge almost right angular, the tip of the mandible extending a little beyond the outer edge of the labrum; dorsulum finely reticulated, nearly polished, punctured, the punctures from one to four puncture widths apart; notauli represented by a brownish line; mesopleuræ sculptured somewhat like the dorsulum but more distinctly reticulate; scutel more coarsely punctured and less reticulate than the dorsulum; mentanotum indistinctly punctured and densely reticulate; first recurrent vein received by the second submarginal cell nearer to the first transverse cubitus than the nervulus is to the basal vein on the median vein, second recurrent vein interstitial with the second transverse cubitus; scopa atypical, with long crinkled rather dark brownish hairs; hind metatarsi narrower than mid metatarsi; propodeum shiny, its enclosure finely wrinkled at base, elsewhere finely reticulated, propodeal pleuræ sculptured much like the mesopleuræ but not so distinctly; abdomen satiny, sparsely, rather indistinctly punctured, except the fifth tergite which is rather distinctly, coarsely punctured, pygidium slightly convex, rounded at apex, the apical and lateral margins slightly turned up.

---

[1] 1896, Proc. Acad. Nat. Sci., Phila.

Allotype.— American Museum of Natural History, New York, N. Y. Sufficiently like the female to be readily associated therewith, maculation greatly reduced, the tergal bands of the abdomen represented by a yellow mark on each side of the second, third and fourth tergites, pronotum with a small yellow spot on each side of the hind margin; mandibles nearly straight, the tip of the left mandible extending to the base of its fellow, cheeks trapezoidal.

59.88,1P

Article IX.—THE CLASSIFICATION OF THE WEAVER-BIRDS.[1]

BY JAMES P. CHAPIN.

Plates VI–X.

CONTENTS.

	PAGE.
Current Views	243
Mouth-markings of Young Estrildinæ	246
Taxonomic Value	248
Skeletal Characters	249
Textoridæ	250
Ploceidæ — Ploceinæ and Estrildinæ defined	251
Philetairus	252
Position of *Parmoptila*	254
General View of the Whydahs	256
Dry Season or Winter Plumages in the Ploceinæ	259
Summary	260
Proposed Classification of the Ploceidæ	261
Classifications of Reichenow and Shelley	262
Appendix (Notes on Nesting, etc.)	265
Family Textoridæ	265
Family Ploceidæ	266
Subfamily Ploceinæ	266
Subfamily Estrildinæ	273

The one external character which enables us to distinguish the Ploceidæ, or Weavers, from the Fringillidæ at a glance is the condition of the tenth or outermost primary. In the latter this feather is always very small and rotated to a concealed position on the dorsal surface of the wing, whereas in the Ploceidæ, with possibly one exception, it always lies in plain view on the under side of the wing. This distinctive feather, however, shows great diversity in size among the different genera of Weavers, in accordance with which it has long been the custom to separate the family into two or three subdivisions.

CURRENT VIEWS.

All the well known ornithological works recognize such subfamilies, sometimes two: the Viduinæ (to quote the Cambridge Natural History), in which this quill is small and falcate, and the Ploceinæ, in which it is larger. By Professor Reichenow the first group is called the Spermestinæ, and by Captain Shelley, in Birds of Africa, it is divided again into the Viduinæ, most of which have elongated tails, including the Whydahs and Bishop Birds, and the Estrildinæ, comprising the Waxbills and their allies.

---

[1] Scientific Results of the Congo Expedition. Ornithology, No. 4.

Turning back to the 'Conspectus Generum Avium' of Bonaparte, 1850, we find these same three subfamilies already recognized. Though the distinguishing characters were not enumerated it is perfectly clear that the divisions were not based upon the size of the tenth primary, but rather on the general form and style of coloration.

Professor Newton, too, was in favor of three subfamilies, for in his 'Dictionary of Birds,' p. 1029, he wrote: "Following Sundevall,[1] Dr. Sharpe (Cat. Birds Br. Mus.) divides the Ploceidæ into two subfamilies — Viduinæ and Ploceinæ . . . . — a proceeding that is confessedly artificial and not to be recommended, since it obscures the very natural group of Viduinæ proper by associating with them a promiscuous company far better left as it was by Gray and others in a distinct group as Spermestinæ, or more correctly Estrildinæ, composite though this group may be, and requiring the separation of its Australian members *Donacilda* and *Poophila,* . . . . to say nothing of . . . . *Pyrenestes, Euplectes* or *Pyromelæna.*"

It will be shown later that the group of Viduinæ is not at all a natural one, but we shall first consider the tenth primary as a basis of classification. A convenient standard of comparison is the length of the upper primary coverts. According to Reichenow the members of the Spermestinæ have the outer primary scarcely as long, or shorter than the primary coverts, the Ploceinæ have it distinctly longer.

This would surely be a convenient means of distinguishing them, but it does not express real relationship, and such subfamilies are not wholly natural divisions. There are numerous exceptions, and it is my belief that we should have a much better idea of inter-relationships in the Ploceidæ if we paid more attention to the other characters.

For example, the genus *Spermospiza,* which has a relatively long tenth primary, resembles in most respects certain genera of the Estrildinæ, especially *Hypargos, Pytilia* and *Pyrenestes,* and there Bonaparte placed it. Captain Shelley, also, in 'The Ibis,' 1886 (Review of the Ploceidæ of the Ethiopian Region), frankly included it in that subfamily. Other authors, however, have since transferred it to the Ploceinæ on this one character, and Shelley himself later reversed his decision.

Clytospiza monteiri, as pointed out by the same authority (Birds of Africa, IV, p. 296), is in the same predicament; but Reichenow boldly refers it to *Hypargos* (in the Estrildinæ) ignoring the fact that not only his *H. monteiri,* but *H. dybowskii* as well, have the outer primary as long as in many of the Ploceinæ, whereas in *H. schlegeli* it is minute, shorter than the primary coverts. (See Fig. 1, B and C). Even in *Nesocharis capistrata* this feather is slightly longer than the primary coverts, though nobody has yet placed it in the Ploceinæ.

---

[1] Methodi Naturalis Avium Disponendarum Tentamen, 1872.

On the other hand, *Brachycope anomala,* among Ploceinæ, has it scarcely longer than the coverts. This genus is rare in collections, but it deserves attention, for it furnishes an excellent link between *Ploceus,* or the group of genera included under that name by conservative writers, and *Pyromelana,* including the Bishop-birds.

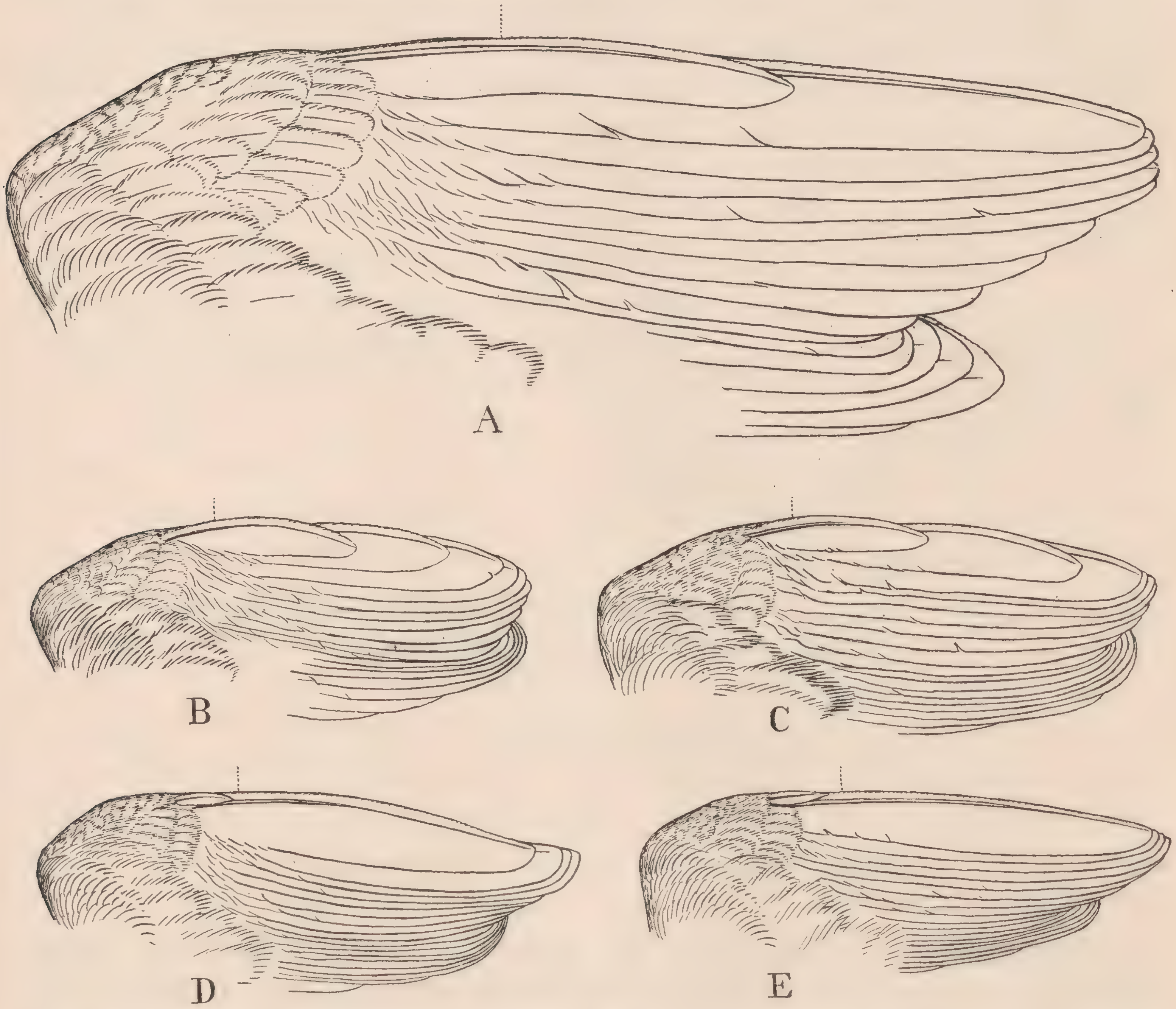


Fig. 1. Wings of: A. *Dinemellia dinemelli;* B. *Hypargos dybowskii;* C. *Clytospiza monteiri;* D. *Parmoptila jamesoni;* E. *Nigrita fusconota.* All natural size; the dotted line marking the length of the primary coverts.

Why, then, are the latter, along with *Quelea* and *Coliuspasser,* considered as allies of *Vidua* and kept in the Estrildinæ? Simply on account of the small size of this one feather. Yet, in other ways, the form of the bill and feet, the manner of constructing their nests, they agree much more closely with the Ploceinæ, and it is to this subfamily I am sure that they belong.

Dr. A. G. Butler, whose long experience with Weavers as cage-birds is summed up in his 'Foreign Finches in Captivity,' seems to have shared a few of my doubts. On page 303, we read: "That this distinction [the length of the tenth primary] is a real one, important as an aid to classification, cannot be questioned; it is also probable that the length of this primary may indicate affinity; but as this particular feather evidently varies in length in the same subfamily, it is equally clear that some of the Viduine weavers must more nearly approach their Ploceine cousins than others do; so that, from the view of a student of living birds, it is necessarily to be regarded as of less importance than a total dissimilarity of habits, winter plumage, song, etc."

Dr. Butler's classification, accordingly, as outlined in his table of contents, attempts to show the affinity between *Pyromelana*, *Quelea*, and the Ploceinæ, though he is still unwilling to depart radically from the systems in vogue.

I. *Whydah-like Weavers.*
    1. Astrilds or Waxbills.
    2. Grass-finches.
    3. Mannikins.
    4. Whydahs (= *Hypochera* + *Vidua* + *Coliuspasser*).
    5. Weavers (= *Pyromelana* + *Quelea*).
II. *Typical Weavers.*
    Foudia + *Nesacanthis* + *Ploceus.*

MOUTH-MARKINGS OF YOUNG ESTRILDINÆ.

It is partly from the viewpoint of the field ornithologist that I shall attempt to settle these questions, and I am sure we can find a much better basis of classification, founded upon a combination of characters, instead of a single one. In the Congo basin, where my acquaintance was made with this the commonest family of African birds, certain important genera usually referred to it, such as *Textor*, *Dinemellia* and *Philetairus*, do not occur, but it is nevertheless well represented, our collection from that region containing eighty-two different forms. Because of their abundance and the fact that their nests are easy to find, and frequently brought to us by natives, we had an opportunity of examining the young of many species. I had not spent three months in Africa before I began to notice the curious spotting and swellings about the mouth of the young *Pyrenestes* and *Estrilda*. This was in 1909, and from then till early in 1915 I continued to examine and note these decorations of the mouths in nestlings of the Estrildinæ.

In the meantime, Mr. G. L. Bates described and figured in 'The Ibis' (1911) the mouths of a number of young Weaver-finches from the Kamerun. As long ago as 1874, it is true, Dr. Sharpe discovered lobes at the corners of the mouth in the young of *Parmoptila;* and in 1898, Dr. A. G. Butler (Avicultural Magazine, Vol. V, p. 27) had recorded similar markings and swellings in *Poephila gouldiæ,* an Australian Weaver-finch; but of all this I was ignorant. In 'Foreign Finches in Captivity' (1899) Dr. Butler frequently mentioned the "beak-warts" or "wax-skin" in young Weaver-finches, noting their color, but not their form.

Still more recently, Mr. C. F. M. Swynnerton has examined the mouths of many African birds, old and young, and published a beautiful plate in 'The Ibis' (April, 1916, p. 264) including, however, only two Estrildine nestlings.

The first type of buccal decoration in the Weavers to attract my attention was that which Swynnerton has aptly named the "domino" mouth, consisting, as he says, of "symmetrically arranged black spots on a pale palate." In its most typical form, as in *Estrilda* (see Plate VII) there are five such spots, but frequently the posterior pair is lost, though the three remaining retain their position, one in the mid-line, in front of the internal nares, the other two laterally. In addition there is often a blackish ring around the tongue, or two black spots; and a dark crescent on the mandible beneath the tongue, while the corners of the mouth are provided with swellings of regular form and number, often colored yellow or blue and associated with other black spots. But the gape is never so greatly swollen as we are accustomed to find in most young Passerine birds, Woodpeckers and others.

The second type I shall call the "horseshoe" or Spermestine, for I have found it in *Spermestes* and the allied genus *Amauresthes*. (See Plates VI, 1, 4, and VII, 7.) The gape is little swollen or not at all, and instead of spots on the palate we find one or two horseshoes or inverted U-shaped lines. There is a black line around the tongue and two crescents beneath it.

In view of the striking resemblances of these two genera to *Uroloncha* and *Munia,* it seemed probable that the latter would have similar markings when young. Thanks to the generosity of Mr. A. G. Ibbeken, who has presented to me a young Java Sparrow (*Munia oryzivora*) hatched in captivity, my suspicion was confirmed. This bird, about four days old, was the offspring of a pair of the white variety, and interesting for its total lack of down. The yellowish palate bore a single black crescent, but the throat and tongue were pinkish and unspotted, while the white skin of the commissure was considerably swollen. The skin of lores and cheeks was heavily pigmented with black. (Fig. 2.)

Unfortunately for the naturalist, all these curious markings are lost in the adult. The swellings of the gape are absorbed, and the spots in the mouth disappear almost completely, being as a rule obscured by increased pigmentation.

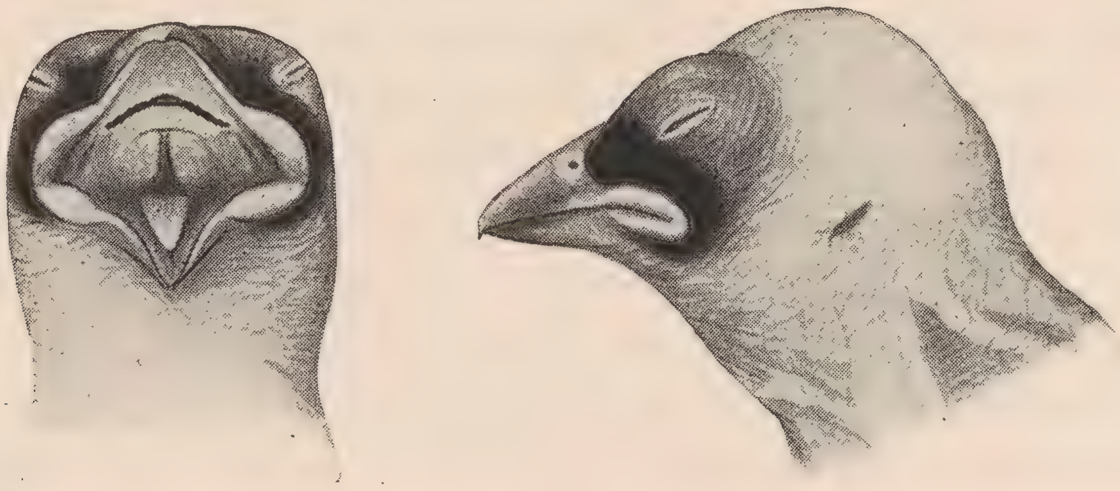


Fig. 2. Mouth and head of young white Java Sparrow (*Munia oryzivora*), about 4 days old. × 2.

Taxonomic Value.

Markings of these two patterns are common among members of the Ploceidæ, but have never been noticed in any other family. Yet the true Weaver-birds (Ploceinæ), as well as certain genera usually placed in the other subfamily — *Coliuspasser* and *Pyromelana*, for instance — lack them, agreeing closely in the swollen yellow or white gape of their young with the Fringillidæ, Turdidæ, and other families.

This character of the nestlings, my field experience has taught me, will furnish a valuable key to the relationships of the different genera of Weavers. I should remove from the Estrildinæ all those forms whose nestlings show no trace of such mouth markings, for they are better placed in the Ploceinæ, as is shown by their nesting habits. This applies especially to the *Pyromelana-Coliuspasser* group. Conversely, species that show the mouth-markings, even though they have a long outer primary are to be considered Estrildine.

In a letter to 'The Ibis,' July, 1916, Captain Collingwood Ingram questioned the constancy of such marks, but a glance at the descriptions or figures of Bates, Swynnerton and myself ought to dispel any doubts at once. I am convinced that such markings offer very important evidences of relationship. It is found, for instance, that the nestlings of many of the Sylviidæ have two black spots on the back of the tongue; one genus currently regarded as Flycatchers (*Chloropeta*) resembles them, but it is well worth investigation. Furthermore, Swynnerton figures the tongue of the young *Centropus burchelli,* bearing a U-shaped black mark. In nestlings of two other African Coucals, *Centropus neumanni* and *C. monachus,* I have found similar markings on the tongue, and even *Coccyzus americanus* and *C. erythropthalmus* have black-tipped tongues. The hair-like down of these young American Cuckoos recalls the remarkable covering of nestling Coucals, but the interior of the mouth is even more highly decorated, the red palate bearing no less than nine raised yellow spots, with one more such spot on the back of the tongue.

It is not my intention to consider the theories which have been advanced as to the possible advantages of such markings. I wish only to use them as showing relationships in the Weavers, for the mere size of the outer primary, as I have already shown, is often misleading. A rearrangement of the groups in accordance with the decorations, or lack of them, in the mouths of their nestlings, is also supported by many other characters such as resemblances in form or structure, and even in color pattern, between various genera, the coloration of the eggs and, as already stated, the habits in nest-building.

SKELETAL CHARACTERS.

The skeletons of *Sitagra, Xanthophilus, Pyromelana, Stictospiza, Estrilda* and *Vidua* show no differences by which the Ploceinæ can be distinguished from the Estrildinæ. Moreover they even agree closely with those of Fringillidæ, such as *Passer, Pinicola* and *Paroaria. Textor albirostris,* however, differs markedly from all the foregoing, both in its skull and its sternum. The fenestræ associated with the orbital foramina are different in extent and number, and an obliquely ascending median bar is present which all the others lack (see Fig. 3). Even Starlings (*Sturnus, Sturnopastor,* and *Spreo*) and Jays (*Garrulus* and *Perisoreus*) resemble the ordinary Ploceid type.

Furthermore, *Textor albirostris* differs from the Ploceids cited above in the form of the sternal rostrum (see Fig. 4) which is less forked and squarer in outline (as viewed from the side). But of far greater weight is the fact discovered by Mr. W. DeW. Miller that this is composed of a *spina interna,* as well as a *spina externa,* the two processes fusing at the tip, and connected lower down by a bony bar. This is the first Passerine bird in which a *spina interna* has been found (see Gadow, Bronn's Thier-Reich, Vögel, II, p. 85).

Such important differences certainly entitle *Textor* to distinct family rank;[1] *Dinemellia* is apparently nearly allied to it, examination of its skull and sternum would tell; and perhaps even other genera will be found to resemble them.

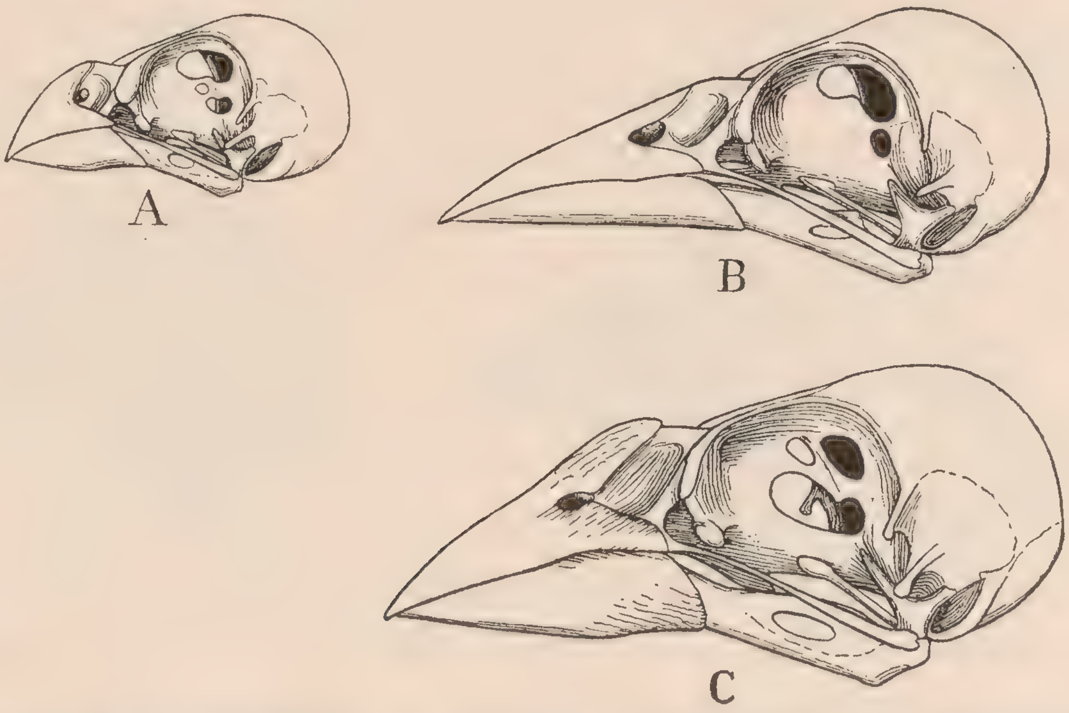


Fig. 3. Skulls of: A. *Vidua serena;* B. *Xanthophilus capensis;* C. *Textor albirostris.* (Natural size.)

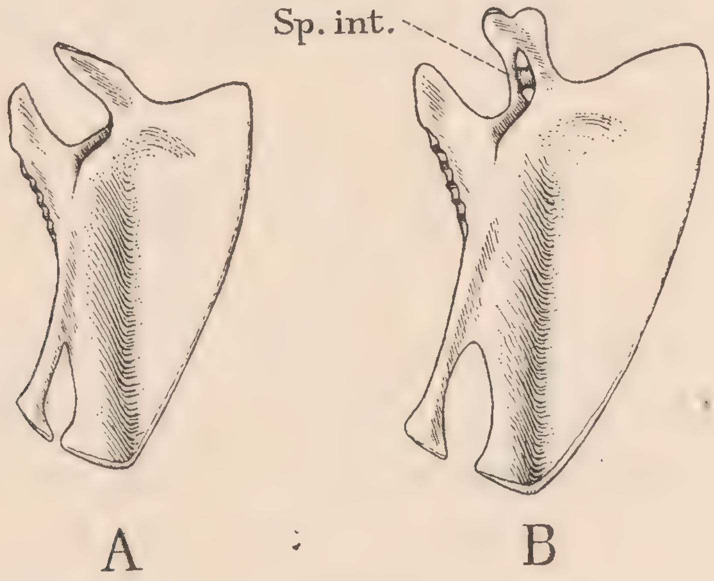


Fig. 4. Sterna of: A. *Xanthophilus capensis;* B. *Textor albirostris.* (Lateral view, natural size.) Sp. int. = spina interna.

TEXTORIDÆ.

For the present I shall refer to this family only *Textor* and *Dinemellia.* Their nesting is remarkable, the great collective abodes being constructed of thorny twigs and grass. The outer primary is large; longer in *Dinemellia* than in any member of the Ploceidæ, and measuring .43 of the total length of the wing (see Fig. 1, A). The eggs are spotted, and so far as known the young show no mouth-markings. In *Textor albirostris* the back of the tarsus, on the inner side, is often scutellate (see Fig. 5).

---

[1] This conclusion had already been reached by Mr. H. C. Oberholser from its external characters alone.

Mr. H. C. Oberholser has kindly called my attention to a passage in Lesson's 'Traité d'Ornithologie' (1831), page 433, where the male of the "Alecto" (*Textor albirostris senegalensis*) is described as possessing an external copulatory organ 9–13 mm. in length, which is especially noticeable in life. Mr. L. S. Crandall, of the New York Zoölogical Park, assures me, however, that such an organ, though very small, is to be seen in certain of the Fringillidæ.

The peculiarities of the "Buffalo Weaver-Birds" have often been alluded to, and usually they have been compared to Starlings, from which they differ internally just as they do from the Weavers. Mr. W. T. Blanford, in Bartlett's 'Monograph of the Weaver-Birds' (page 25), is quoted as follows: "It [*Textor albirostris*] is quite Starling-like in its habits and flight, and belongs to this family rather than to the Fringillidæ. I frequently saw it associating with *Lamprocolius æneus, L. chalybæus,* and *L. chrysogaster.* The massive nests were not unlike those of *Sturnopastor contra.*"

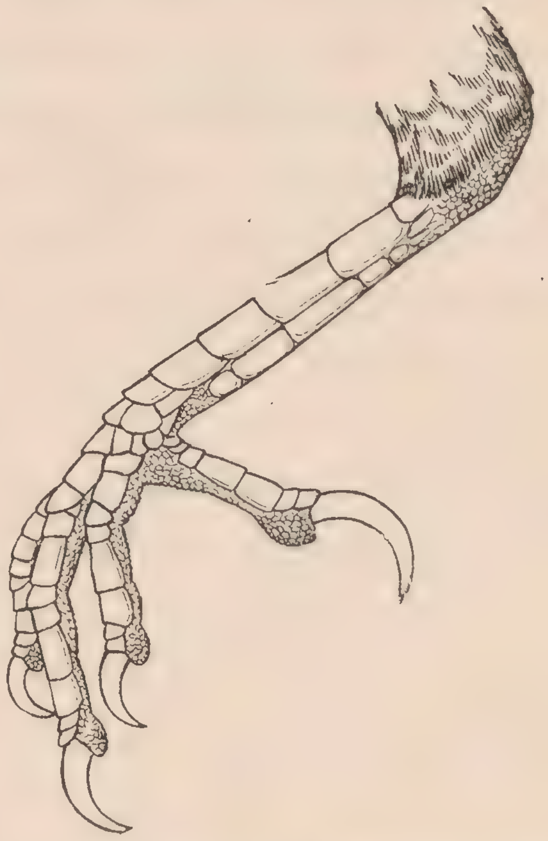


Fig. 5. Foot of a female *Textor albirostris* in the Am. Mus. Nat. Hist., from inner side, to show scutellation. (Natural size).

PLOCEIDÆ — ESTRILDINÆ AND PLOCEINÆ DEFINED.

The two subfamilies Estrildinæ and Ploceinæ will be retained; for convenience we may distinguish them in English as Weaver-finches and Weaver-birds (or true Weavers), respectively, just as Professor Reichenow calls them Webefinken and Webervögel. The name Estrildinæ is to be preferred to that of Viduinæ (both seemingly of equal age) since the latter has often been used expressly to associate *Vidua* with *Coliuspasser.*

As will be seen from the annotated list of genera (see below, page 266), the Ploceinæ are those that really weave their nests, using strands of vegetable fiber, often from the leaves of grasses, palms, or bananas, pulling them in and out, through and through. Their nests are pensile, the typical form rounded, retort-shaped, or like an inverted sock with the entrance opening downward. *Philetairus,* which I refer provisionally to this subfamily (see page 252) departs widely from this type in building a large communal structure of grass.

So far as known all the nestlings of the Ploceinæ lack dark spots in the mouth, and have the gape simply swollen, and yellow or whitish, as is usual in the young of Passerine birds. The interior of the mouth is frequently red, but this color is due to the blood-supply, not to pigment.

The eggs of Ploceinæ are usually colored or spotted, though in a few cases pure white, as occasionally in *Hyphantornis cucullatus, Sitagra mariquensis* and *Ploceëlla javanensis,* and regularly in *Sitagra monacha, S. cabanisi, S. luteola, Icteropsis pelzelni, Ploceus baya* and *P. manyar.*

The outer primary is often longer than the primary coverts, but in *Brachycope* and *Foudia* it is only slightly longer, and usually does not exceed them in *Quelea, Pyromelana, Euplectes, Urobrachya, Coliuspasser, Drepanoplectes* and *Diatropura.*

The Estrildinæ (see page 273) are to be distinguished by the fact that their nestlings exhibit dark pigmented spots or lines in the mouth, often with small colored wattles or lobes at the gape. These latter are lacking in *Spermestes, Amauresthes* and *Munia,* which have lines on the palate instead of spots. These three genera, with others no doubt still to be ascertained, are thus rather distinct from the rest of the group.

The Weaver-finches can scarcely be said to merit their name, for they build nests which are not pensile, nor really woven, their most typical form being flask-shaped, built mostly of flowering or seed-bearing grass-heads tightly packed, but pulled through at most only once or twice. The entrance opens at the side. Many of the Weaver-finches simply build covered, sparrow-like abodes, using dry leaves and feathers as well, and not infrequently, as in the case of *Clytospiza,* they have been found to appropriate abandoned nests of other species to which they may or may not add a lining. A striking thing about their nesting-habits — in many species, at least,— is that the parents neglect to clean the nest of excrement, with the result that it becomes extremely foul before the young are ready to leave it. This is rarely the case with the Ploceinæ, though I have noticed it in *Amblyospiza.*

So far as I can ascertain, the Estrildinæ in every case lay pure white eggs, generally in larger numbers than those of the true Weavers.

The tenth primary is usually, but by no means always, as short or shorter than the primary coverts. The principal exceptions have already been cited. In view of the condition of the mouth of their nestlings, *Spermospiza, Clytospiza* and *Nesocharis* are plainly Estrildine, their large outer primaries notwithstanding.

PHILETAIRUS.

The famous sociable Weaver of South Africa (*Philetairus socius*) is a remarkably sparrow-like bird, which has sometimes been placed in the Ploceidæ, sometimes in the Fringillidæ. Some descriptions give the impression that the tenth primary is visible and it is so figured in Gray's 'Genera of Birds' (1849); but specimens in the Philadelphia Academy of Natural Sciences and the Museum of Comparative Zoölogy show it to be very small, and concealed by the ninth, just as it is in Fringillidæ (see Fig. 6). Why not include it, then, in that family, as Reichenow does? After careful examination of these specimens I came to the conclusion that as far as the form of the compressed bill, of the feet, and other parts were concerned, *Philetairus* might be a Finch; yet I prefer to keep it in the Ploceidæ, for the following reasons.

We believe that the evolutionary tendency among Oscines is from the ten-primaried to the nine-primaried condition. Practically all the Fringillidæ have already attained the latter condition, but in the genus *Emberizoides* of South America, at least, the tenth primary is frequently visible from the under side of the wing.

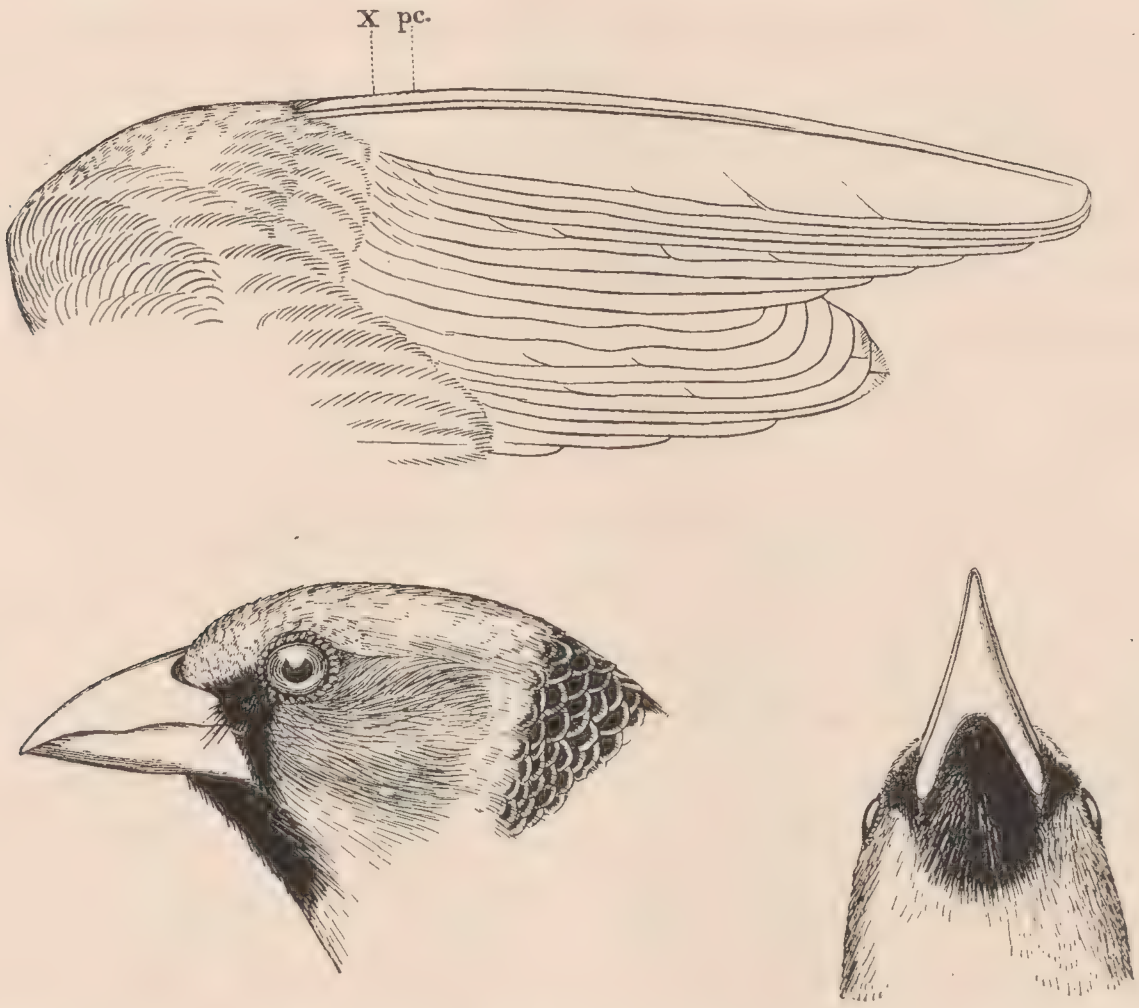


Fig. 6. *Philetairus socius.* Natural size. X marks the tip of the 10th primary, pc. that of the longest primary covert.

The Ploceinæ, on the other hand, show every stage from a wing with a large tenth primary (*Malimbus* and *Hyphantornis* for example) to what is practically a nine-primaried wing, as in *Pseudonigrita,* with only a very small acuminate tenth, still visible on the under side of the wing. If we consider *Philetairus* as the final stage of this series, the step from *Pseudonigrita* to it is extremely slight. Captain Shelley, indeed, united these two genera, and I can see at present no reason why we cannot keep the Sociable Weaver among the Ploceinæ.

In its nesting it is certainly very far from the Finches, the huge communal nest reminding us in a way of those of Textoridæ; but it is made of grass. Brehm[1] and Grant,[2] among the authors consulted, state that the materials are really woven, and it is hard to see how the structure could be held together otherwise. We can thus compare it better with nests of Ploceinæ, which so often build in large colonies. Furthermore, the way that a Weaver may have arrived at this stage in architecture, starting from the ordinary colonial habit, is at least suggested by Grandidier (Histoire Naturelle des Oiseaux de Madagascar, I) in the case of *Ploceus sakalava,* which has much the same habits as *Nelicurvius nelicourvi,* but the nests differ in being constructed so closely together that they form but a single mass. Even *Hyphantornis abyssinicus* has been seen by the writer to attach as many as three nests together, though in such a case only a single one was actually utilized.

But if we decide to retain *Philetairus* among the Weavers, the last clear-cut distinction between Fringillidæ and Ploceidæ is lost. Still I scarcely need to remind the reader how many other Passerine families are equally incapable of clear definition.

POSITION OF PARMOPTILA.

Among the Ploceidæ we find much the same variation in the size and stoutness of the beak as in the Fringillidæ; and similarly the Ploceinæ and Estrildinæ parallel each other to a great extent, both groups containing rather slender-billed as well as exceedingly heavy-beaked representatives, ranging in the former subfamily from *Icteropsis* to *Amblyospiza,* in the latter from *Parmoptila* to *Pyrenestes.* Mere thickness of the bill is of little systematic value.

Parmoptila has never before been referred to the Ploceidæ; but my investigations prove this to be its proper place, in spite of former opinions about its systematic position. In the 'British Museum Catalogue of Birds,' X, p. 63, Dr. Sharpe, following Cassin, included the genus in the Dicæidæ, but in the 'Hand List of Birds,' IV, p. 233, referred it to the Sylviidæ, where Captain Shelley (Birds of Africa, I, 1896) had already placed it (along with *Pholidornis*) near *Hylia* and *Eremomela.* Professor Reichenow considers both genera as Titmice.

From my first acquaintance with *Parmoptila jamesoni,* I have felt that it really belonged with the Ploceidæ, probably near *Nigrita*. Fig. 7 shows the resemblance in the form of the bill and the curve of the cutting edge of the maxilla. Their small outermost primaries are much alike (see Fig. 1, D and E), and only the color pattern seems really very different, yet even in this *Parmoptila* does not approach either the Dicæidæ, the Sylviidæ or the Paridæ.

---

[1] Bird Life, p. 314.

[2] Guide to the Gallery of Birds (British Museum), 1905, p. 132.

This opinion, based at first on the external form of the adult, was confirmed by the spotting in the mouth of the young bird, which is essentially the same as in a young Waxbill or Negro-finch. In *P. jamesoni* the skin at the corners of the mouth is black, bearing three small yellowish balls, the interior of the mouth light yellow, with five black spots on the palate — a typical "domino" mouth — and a black crescent beneath the tongue.

These three lobes at the gape were first noticed by Dr. Sharpe in a young bird preserved in alcohol, which he described as *Lobornis alexandri* (Ann. Mag. Nat. Hist. (4), XIV, 1874, p. 63), but which has since proved to be the young of *Parmoptila woodhousei*. They are well shown in the 'British Museum Catalogue of Birds,' Vol. X, plate ii. In view of these markings and wattles I think there can be no doubt of its affinities.

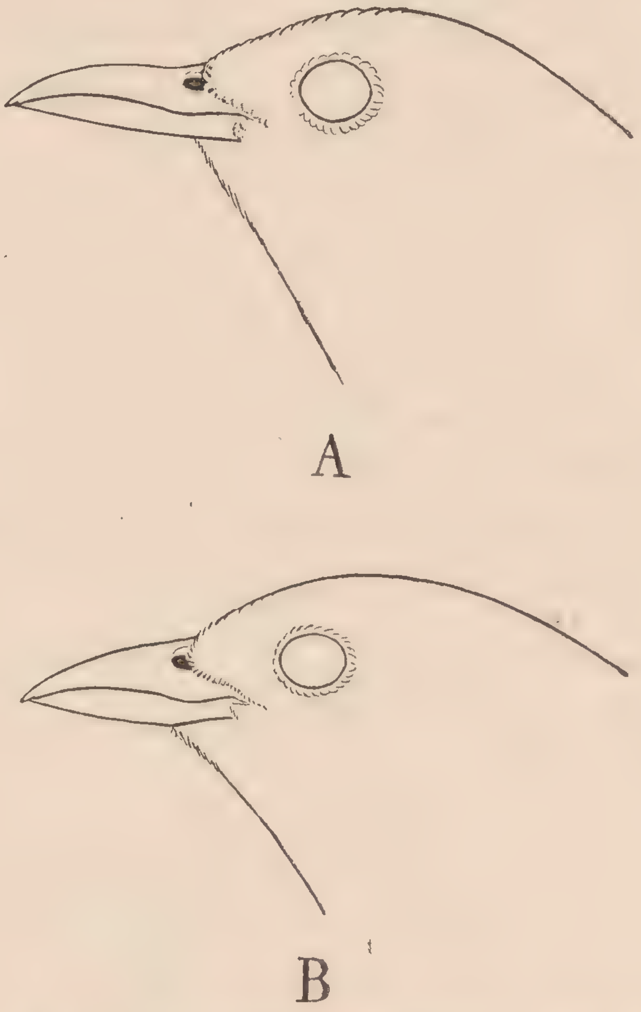


Fig. 7. A. *Parmoptila jamesoni.* × $\frac{3}{2}$. B. *Nigrita fusconota.* × $\frac{3}{2}$.

In its nesting, too, *Parmoptila* agrees with the Weaver-finches rather than with the Flower-peckers, Warblers, or Titmice. I was not fortunate enough to discover a nest of *P. jamesoni* — it is a rather rare forest bird — but that of *P. woodhousei* has been described by Bates (Ibis, 1908, p. 329; 1909, p. 67) as a large dome-shaped pile of dried leaves and grass, 200 mm. high, lined with fine fibers of dry plantain leaves, with the entrance at the side; or a rough mass as big as a half-gallon measure, composed of dry grass, with a quantity of green moss thrown loosely over the outside, placed on a horizontal twig. The eggs number three to four and are pure white. Such nests compare very well with those of *Nigrita canicapilla* and *N. fusconota*. (See p. 275).

Pholidornis is evidently a near ally of *Parmoptila*, its bill is similar though much slenderer, and the form of the nostril is the same. But here again we have an indication of the slight importance that is to be attached to the tenth primary. In *Parmoptila jamesoni* this narrow, pointed feather is shorter than the primary-coverts, whereas in *Pholidornis rushiæ,* as measured from two specimens in the Philadelphia Academy of Natural Sciences, it exceeds the primary-coverts by 5 to 5.5 mm., and its length equals .28 of that of the whole wing. When the nest and young of *Pholidornis* are found they will, I feel sure, justify its inclusion among the Estrildinæ.

General View of the Whydahs.

In Dr. Sharpe's 'Hand List of Birds' all the Ploceidæ the males of which have long tails in the breeding season, are placed close together at the beginning, and by Captain Shelley and others they were even taken to form a separate subfamily (Viduinæ) to which the Bishop-Birds were necessarily added. But Professor Reichenow, though including them all in his Spermestinæ (= Estrildinæ) does not associate *Vidua* so closely with *Coliuspasser.*

I shall go still further, and separate them in different subfamilies. The lengthened tails in the two groups of Whydahs — let us take *Coliuspasser* and *Vidua* as examples — have nothing in common but their length and seasonal molt. They are of fundamentally different pattern (as shown in Fig. 8); in *Vidua* and the three very closely allied genera *Tetrænura, Linura,* and *Steganura,* it is only the two median pairs of rectrices that are renewed at the prenuptial molt, and they are the only ones elongated. In addition they are often rotated so as to press their lower surfaces together, forming a sort of tube in *Vidua serena.*

In *Coliuspasser,* on the other hand, all twelve rectrices are renewed, and all are lengthened, the outer ones often more so than the median; and all of them may be twisted in just the opposite sense, so as to form the carinate tail so conspicuously displayed by the courting male in flight. That of *Diatropura* is built on precisely the same plan, though complicated by the prolongation of some of the under coverts. The striking development of the tail in the two different groups of Whydahs is simply a case of parallelism, the young *Vidua* having a "domino" mouth, that of *Coliuspasser* not. They are all typically birds of the open grass country, where the seasonal change in weather and vegetation is very pronounced.

Widow-birds of both these types are usually held to be polygamous, because the proportion of adult males in breeding plumage is usually small as compared with the birds in streaked brown dress accompanying them. I am not convinced, however, that this is true, as in the case of *Vidua serena,* I have found that many of those resembling females, even among flocks with a few long-tailed escorts, are actually immature males — they can be recognized in life by their orange-red beaks. The evidence against *Coliuspasser* is even less conclusive.

Besides the Widows among the true Estrildinæ I know of only one genus, *Hypochera*, which has a dull winter plumage. *Hypochera*, however, is nothing but a short-tailed *Vidua*, its similarity in color to *V. hypocherina* being well known. Besides resemblances in outward form we may even note certain striking similarities in habits. I have observed the black males

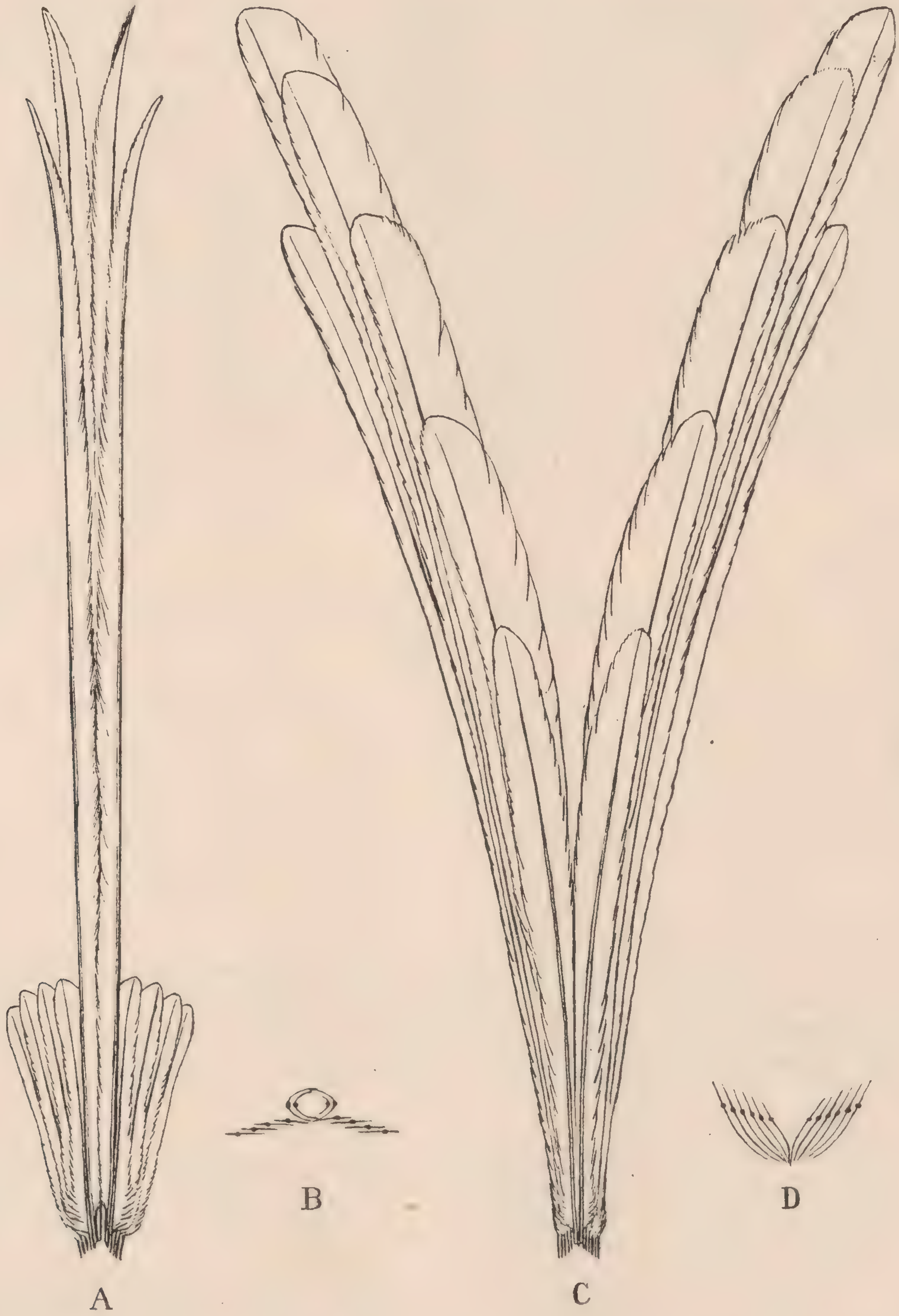


Fig. 8. Tails of Whydahs, with diagrammatic cross-sections. × ½. A and B. *Vidua serena;* C and D. *Coliuspasser concolor.*

of *Hypochera,* or even brown immature individuals hovering in the air beside their mates in the same way as cocks of *Vidua serena.*

One other very important character linking the genera *Hypochera, Vidua,* and *Steganura*[1] is the peculiar ossification of the brain-case. For many years it has been my custom to determine the age of Passerine birds I skinned by an examination of the skull, a method I learned from Mr. W. DeW. Miller, and which has been described by Dr. Jonathan Dwight (Plumages and Moults of the Passerine Birds of New York, p. 77). In almost all adult Oscine birds, the roof of the brain-case (frontals and parietals) is composed of a double layer of bone, united by numerous little rods, which appear on the outside, by transmitted light, as dots. In their nestlings, as every collector knows, there is only a single transparent layer of bone. As the young bird grows this clear area becomes restricted, though traces of it may still be seen for five or six months and sometimes longer (see Fig. 6 B). It usually persists longest in the middle of the frontal region, but not infrequently, as in Swallows, in the parietals, forming a clearer spot at each side. This is a trustworthy sign of immaturity, and often outlasts the characteristic plumage of the young bird.

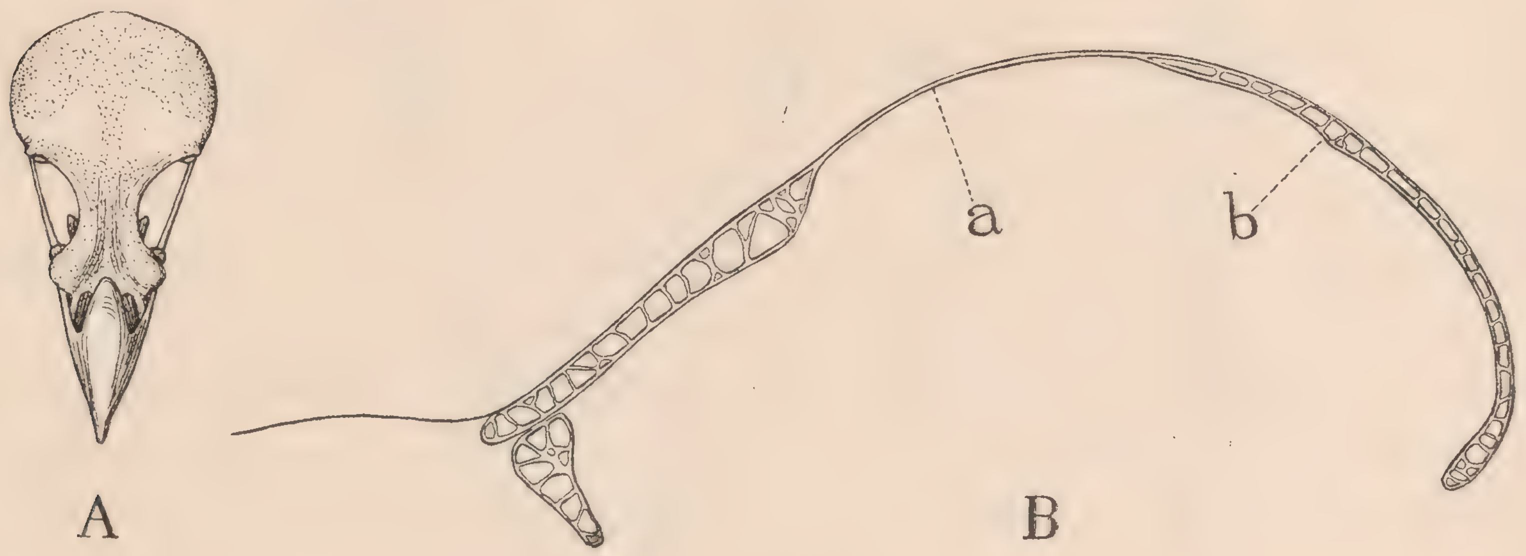


Fig. 9. A. Skull of *Steganura paradisea,* ♂ ad., with areas of thin bone (without dots), on top of the braincase. × 1. B. Sagittal section through roof of braincase of a young warbler, *Dendroica striata,* about 2½ months old. a, thin posterior part of frontal, a single layer of bone. b, parietal and occipital regions, composed of a double layer with connecting rods. × 4.

But in the case of *Hypochera, Vidua* and *Steganura,* I have never found a single example, male or female, in spite of the large number of undoubted adults examined, where the skull had reached that stage of ossification, with a complete double layer of bone, which characterizes practically every mature Oscine bird. There is always a large clear area in the frontal region, which remains throughout life. (See Fig. 9 A).

On the other hand *Coliuspasser* is normal in this respect, and shows no approach to *Vidua.* In fact I know of only one other similar case, *Salpornis salvadori,* also an African bird, but of the family Certhiidæ.

---

[1] *Tetrænura* and *Linura* will surely be found to agree.

DRY-SEASON OR WINTER PLUMAGES IN THE PLOCEINÆ.

The alternation of a bright nuptial plumage with dull dry-season dress, while comparatively rare in Estrildinæ, is more common among the Ploceinæ, particularly those inhabiting open country, for in the equatorial forests there is little change of season. Examples of this are *Ploceus, Ploceëlla, Anaplectes, Foudia, Quelea, Pyromelana, Urobrachya, Coliuspasser* and *Diatropura,* and among the typical Ploceinæ I can also cite, from personal observation: *Sitagra tænioptera, S. luteola, Hyphantornis cucullatus abyssinicus,* and *Othyphantes baglafecht.* As a rule only the males undergo a change of any extent, but in one species at least, *Pachyphantes superciliosus,* the female, too, has a very much brighter nuptial dress, differing from that of the adult male only by her black forehead.

FURTHER INVESTIGATION NECESSARY.

From the preceding remarks, it should be clear that in order to decide on the relationships of the various genera of Ploceidæ, the examination of nests and young is indispensable. Nestlings of *Uroloncha, Aidemosyne,* as well as of *Munia* will be found to resemble — I suspect — those of *Spermestes* and *Amauresthes,* in view of the external appearance of the adults. Bates's example should be followed by ornithologists in the East Indies and Australia. With *Paludipasser,* for instance, which has a minute tenth primary, I can only guess that it may be Estrildine, from a general likeness to *Sporæginthus subflavus.* Similarly the adult of *Anomalospiza* shows a decided resemblance to *Paludipasser* in its bill, and has a tenth primary of about the same size; but a knowledge of its nest and young would enable us to settle the question not only as to its subfamily, but as to whether Sharpe and Reichenow are right in transferring it to the Fringillidæ.

Closely related to *Anomalospiza* is *Heliospiza noomeæ,* described as a Fringillid by Dr. J. B. W. Gunning in the 'Journal of the South African Ornithologists' Union,' 1907, page 208. The culmen is a little more curved, the lower mandible narrower and less high; while the outermost primary is more distinct.

It is greatly to be hoped that South African ornithologists will investigate the nesting of these doubtful Ploceids, and examine the mouths of their nestlings, as well as those of *Philetairus socius, Pseudonigrita, Ploce-*

passer, and *Sporopipes.* The skeleton, and particularly the sternum, of the last-named genera are worthy of attention.

Important features of many other Ethiopian genera are still in doubt — not to mention the Oriental and Australian representatives — but enough has been said, I trust, to point the way to a far more satisfactory grouping of the Ploceidæ than any at present in vogue.

SUMMARY.

The classification of the Weavers now to be offered, and based both on field observations and on comparative study, divides them in two subfamilies, not however according to the relative length of the tenth primary, but upon the coloration in the mouths of their nestlings, and the condition of the swellings or lobes at the commissure — characters which are found to be correlated with differences in the manner of nest-building and in the coloration of the eggs.

It commences with what are believed to be the less specialized forms, the Ploceinæ, for although they are so skilful in constructing their nests, they have for the most part retained the large tenth primary, and their nestlings have no spotting in the mouth; whereas, among the Viduinæ even the duller-colored, short-tailed forms show two specialized features, the great development of the mouth-markings in the young, and as a rule, a small tenth primary. Even their uncolored eggs may be a specialized character.

Neither of these divisions can be considered as leading up to the other; connecting links are lacking, and they parallel each other in the progressive reduction of the outermost primary, so that this feather is really of little systematic importance. In both groups, moreover, we find forms with greatly lengthened tails.

To aid in comparison, the systems of Reichenow and Shelley are also appended. In spite of an apparent similarity between that of Prof. Reichenow and my own, it will be seen that besides removing *Textor* and *Dinemellia* from the Ploceidæ, I have subdivided the family on a totally different basis, so that *Quelea, Pyromelana, Euplectes, Urobrachya, Coliuspasser, Drepanoplectes, Diatropura,* and *Pseudonigrita* are referred to the Ploceinæ, while on the other hand *Spermospiza* is transferred to the Viduinæ. *Philetairus* and *Anomalospiza,* which Reichenow placed in the Fringillidæ, and *Heliospiza* as well, are retained in the Ploceidæ. Finally, *Parmoptila,* referred by Reichenow to the Paridæ, and by others to the Dicæidæ or Sylviidæ, is proved to belong among the Estrildinæ, where *Pholidornis* is also placed provisionally. Genera about the position of which there is still any doubt are enclosed in brackets.

Proposed Classification of the Ploceidæ.

Ploceinæ
Sporopipes
[Histurgops]
Plocepasser
Pseudonigrita
[Philetairus]

*Amblyospiza
*Pachyphantes
Ploceus
Ploceëlla
*Sitagra
*Hyphantornis
Hypermegethes
*Melanopteryx
*Malimbus
Xanthophilus
Othyphantes
*Phormoplectes
*Hyphanturgus
Nelicurvius
Symplectes
Notiospiza
Anaplectes
Foudia
*Brachycope
Quelea
*Pyromelana
Euplectes
Urobrachya
*Coliuspasser
Drepanoplectes
Diatropura

Estrildinæ
[Pseudospermestes]
*Spermestes
*Amauresthes
Aidemosyne
Uroloncha
*Munia

[Pholidornis]
*Parmoptila
*Nigrita

*Clytospiza
*Spermospiza
Cryptospiza
*Pyrenestes

‡Tæniopygia
Amadina
Ortygospiza
[Paludipasser]
[Heliospiza]
[Anomalospiza]

*Hypargos
Bathilda
*Pytilia
*Lagonosticta
*Sporæginthus
Ægintha
Coccopygia
Stizoptera
*Estrilda
*Nesocharis
Zonæginthus
Emblema
Stictospiza
*Uræginthus
Granatina
Neochmia
Staganopleura
Reichenowia
†Erythrura
†Poephila

*Hypochera
Vidua
Tetrænura
Linura
Steganura

---

* The young have been examined by me.

† The young have been examined by Dr. Sharpe. [ ] Position still in doubt.

‡ The exact affinities of this and the other Australian genera may not be very clear; but they are all surely Estrildine.

Reichenow's Classification (Die Vögel, 1914).

Ploceinæ

Textor
Dinemellia
Histurgops
Plocepasser
Sporopipes
Malimbus
Anaplectes
Notiospiza
Foudia
Symplectes
Phormoplectes
Othyphantes
Hyphanturgus
Melanopteryx
Hyphantornis
Hypermegethes
Sitagra
Xanthophilus
Ploceus
Ploceella
Nelicurvius
Brachycope
Amblyospiza
Spermospiza

Spermestinæ

Pyrenestes
Quelea
Pyromelana
Euplectes
Urobrachya
Coliuspasser
Diatropura
Drepanoplectes
Amadina
Spermestes
Tæniopygia
Amauresthes
Oryzornis
Munia
Staganopleura
Neochmia
Hypargos
Emblema
Erythrura
Reichenowia
Pytilia
Nigrita
Pseudonigrita
Cryptospiza
Estrilda
Stictospiza
Lagonosticta
Ortygospiza
Neisna
Uræginthus
Hypochera
Vidua
Tetrænura
Linura
Steganura

Philetairus
Anomalospiza
} Fringillidæ

Parmoptila
Pholidornis
} Paridæ

Shelley's Classification (Birds of Africa, I, 1896).

Viduinæ

Hypochera
Vidua
Coliipasser
Urobrachya
Pyromelana
Quelea

Estrildinæ

Pyrenestes
Amadina
Munia
Uroloncha
Nigrita
Philaeterus
Cryptospiza
Coccopygia
Granatina
Estrilda
Lagonosticta
Pytelia
Hypargus

Ploceinæ

Spermospiza
Clytospiza
Sporopipes
Amblyospiza
Dinemellia
Textor
Histurgops
Ploceipasser
Sharpia
Anaplectes
Malimbus
Melanopteryx
Nelicurvius
Pachyphantes
Ploceus
Foudia
Neshyphantes
Sycobrotus
Othyphantes
Heterhyphantes
Hyphanturgus
Sitagra
Xanthophilus
Hyphantornis
Cinnamopteryx

Parmoptila } Sylviidæ
Pholidornis

Linear arrangements such as these are naturally inadequate to express inter-relationships within the subfamilies, so I have prepared a diagram illustrating their affinities and apparent development — as far as we can judge from living forms — beginning with those that have preserved a long tenth primary and a tail of normal shape, and culminating in the Whydahs, with greatly lengthened rectrices and tiny outermost primary. The old subfamily division is indicated by the horizontal dotted line separating the forms with a large tenth primary from those with a small one. The artificial character of such a classification is evident.

Strictly speaking this is not a phylogeny, certain genera are placed lower than others, not because they are believed to be actually ancestral, but because among the living representatives they approximate most nearly the probable ancestors. In order to avoid confusion, only a small number of generic names have been utilized, but the position of the remainder may easily be understood through comparison with the complete list.

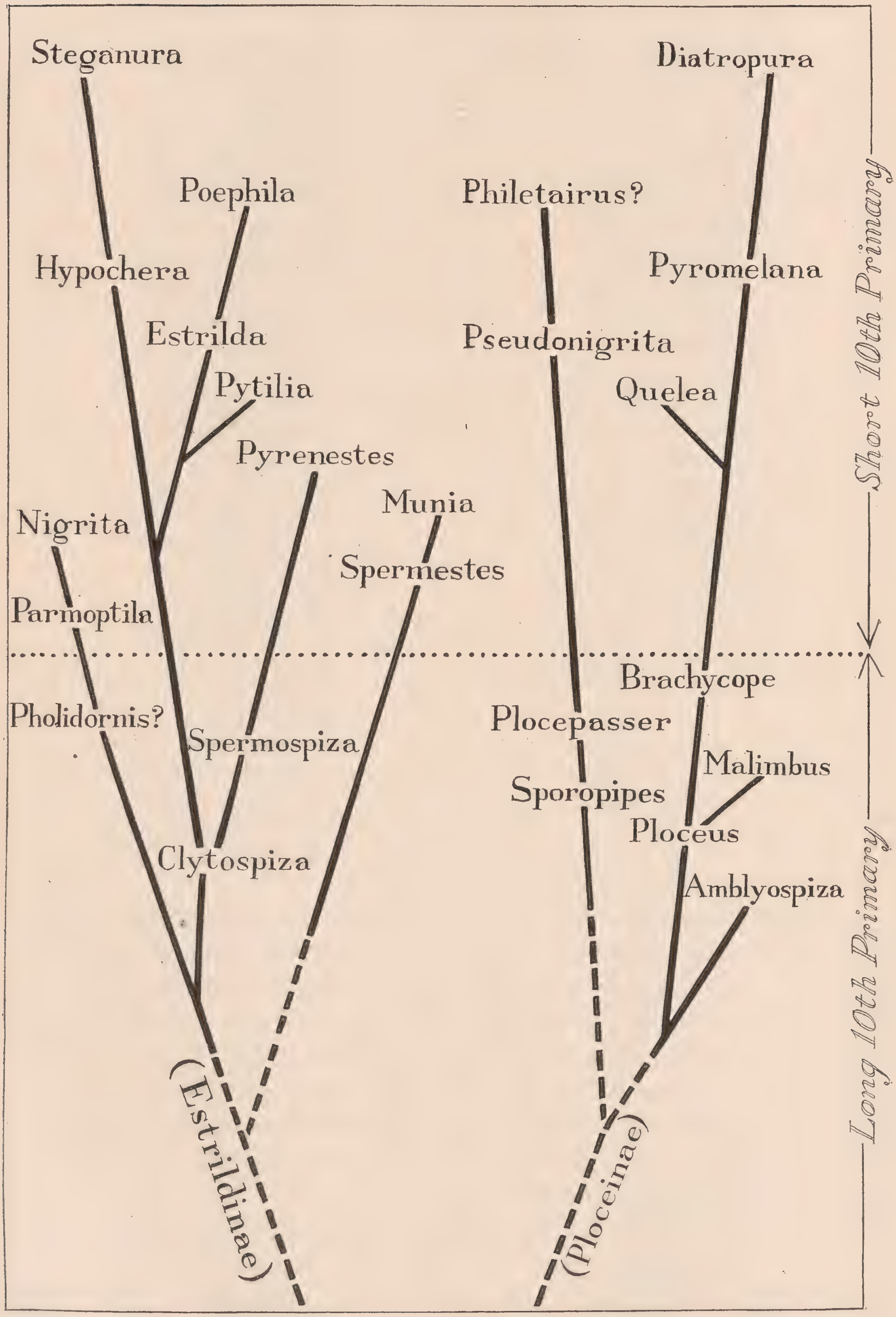


Diagram to illustrate the apparent development of the Ploceidæ.

APPENDIX.

The following series of short notes on genera of Textoridæ and Ploceidæ, particularly those of Africa, has to do with their nests and eggs, the size of the 10th primary (in refutation of the older basis of classification) and, among the Estrildinæ, the mouths of the nestlings. Some of this material is new, but a great deal with regard to nesting has been gathered from the work of reliable investigators, to whom credit is given in each case.

Family TEXTORIDÆ.

Textor.

Nest.— *T. niger:* Generally from four to seven pairs of the Buffalo Weaver-bird unite to build a common nest of closely interwoven sticks and thorny twigs, oval openings being left here and there, which are afterwards lined with dry grass, and used both as nesting and roosting places. The collective nest, which measures three or four feet across, is repaired and added to from time to time, and often lasts for many years. As many as six of the larger nests may be sometimes seen in a single tree, each inhabited by as many pairs of birds.— Stark and Sclater, Birds of South Africa, I, p. 80.

T. albirostris and *T. a. intermedius* nest in similar fashion, as described in 'Vögel Afrikas,' III, pp. 4 and 5, and Shelley's 'Birds of Africa,' IV, pp. 315–319.

Eggs.— *Textor albirostris:* Three or four, colored like those of a House Sparrow.— Reichenow, Vögel Afrikas, III, p. 4.

T. niger: Three or four, grayish white, streaked and marbled with several shades of gray and brown.— Stark and Sclater, Birds of South Africa, I, p. 80.

Outer Primary.— Large, about twice as long as primary coverts, measuring .35 of total length of wing.

Dinemellia.

Nest.— *D. boehmi:* The nests, several of which are usually built together, are generally placed at the top of a thorny acacia, and are rather untidy-looking structures of grass, a few feathers and leaves, with the entrances on the under side, and are carefully protected by a surrounding of thorny boughs, which encircle not only the nests themselves, but also all the branches leading up to them. A single nest, without the surrounding twigs, measures 9.6 inches.— Böhm, quoted in Shelley's Birds of Africa, IV, p. 314.

D. dinemelli: Said to nest in the same way.

Eggs.— *D. dinemelli:* Eggs green or pale blue, thickly speckled with dark brown (Lort Phillips).— Shelley, Birds of Africa, IV, p. 312.

D. boehmi: Eggs greenish-white, spotted and scrawled with blackish brown.— Shelley, Birds of Africa, IV, p. 314.

Outer Primary.— Very large, measuring, as already stated, .43 of the length of wing (see Fig. 1, A).

Family PLOCEIDÆ.

Subfamily Ploceinæ.

Sporopipes.

Nest.— *S. frontalis:* Large and oval, generally placed in the center of a most impenetrable thorn-bush. It is constructed of dry grass, with a small center chamber well lined with feathers, hair, roots and wool (von Heuglin).— Shelley, Birds of Africa, IV, p. 301.

S. squamifrons: Builds a similar large grass nest.

Eggs.— *S. frontalis:* Grayish-green, with darker lengthened blotches (Emin).— Shelley, Birds of Africa, IV, p. 302.

S. squamifrons: Pale blue-green, thickly marked with blotches and scrawls of brown and rufous (Stark).— Shelley, Birds of Africa, IV, p. 300.

Outer Primary.— *S. squamifrons:* Longer than primary coverts; about .24 of length of wing.

Plocepasser.

Nest.— *P. mahali:* Large, roughly built, kidney-shaped structures, usually placed near the ends of the branches of a mimosa or other thorny tree. They are constructed of long grass-stems, the blades and flowering tops being woven together, the stiff stalks project in all directions. During the winter each nest has two entrances from below, separated in the interior by a narrow bridge of grass on which the birds roost. At the beginning of the breeding-season, one entrance is stopped up with leaves and grass, a shallow cavity being left in which the female deposits two or three eggs. The nests are annually repaired, and last for many years.— Stark and Sclater, Birds of South Africa, I, p. 84.

Eggs.— *P. mahali:* White, suffused with pink, thickly marked, especially at the broad end, with blotches and streaks of deep brown-pink.— *Ibid.*, Birds of South Africa.

P. superciliosus: Two, reddish-white, with rosy red spots inclining to form a zone near the thick end (von Heuglin).— Shelley, Birds of Africa, IV, p. 334.

Outer Primary.— *P. melanorhynchus:* About 6 mm. longer than the primary coverts, equalling .22 of the wing.

Pseudonigrita.[1]

Nest.— *P. arnaudi:* A dozen nests often firmly attached to a single bough, these are strongly constructed of coarse grass with a short sleeve-like entrance-passage hanging down; inside the nest is rounded and lined with seed-down and soft fibers. (Emin).— Shelley, Birds of Africa, IV, p. 133.

By Fischer they are said to resemble nests of *Plocepasser* and have two entrances, one of which is closed just before laying.

---

[1] United by Shelley with *Philetairus;* placed by Reichenow close to *Nigrita*, to some species of which it bears a superficial resemblance in color. I incline to Shelley's view of its affinity to *Philetairus*, on account of the shape of the bill.

Eggs.— *P. arnaudi:* Four, white, with brick-red dots, most numerous toward the thick end (Emin).

Greenish white, with yellowish and violet-brown spots, and a few streaks inclining to form a zone at the obtuse end (Fischer).— Shelley, Birds of Africa, IV, p. 133.

Outer Primary.— Narrow and pointed, shorter than primary coverts.

Philetairus.

Nest.— *P. socius:* Congregates in large flocks, and when breeding many pairs incubate their eggs under the same roof, which is composed by these birds of whole cartloads of grass piled on a branch of some camel-thorn tree in one enormous mass of an irregular umbrella-shape, looking like a miniature hay stack, and almost solid, but with the under surface, which is nearly flat, honey-combed all over with little cavities, which serve, not only as places for incubation but also as a refuge against wind and rain.— Anderson in Stark and Sclater, Birds of South Africa, I, p. 116.

Eggs.— *P. socius:* Three or four, some shade of drab, more or less spotted all over with small dots of brown and grayish purple.— Stark and Sclater, Birds of South Africa, I, p. 118.

Three to four, bluish white, freely mottled towards the large end with small brown dots.— A. Smith, Birds of South Africa.

Outer Primary.— Short, narrow and pointed, lying on upper side of the ninth, just as in Fringillidæ.

Amblyospiza.

Nest.— *A. capitalba saturata:* The most skillful weaver I know, in spite of its clumsy-looking bill. Its neat globular nest, found in patches of tall elephant grass (*Pennisetum purpureum*) is attached to one or two grass-stalks and beautifully woven of fine strips torn from the grass blades. New nests found before the breeding season commenced had rather wide entrances, opening on the side, not below; but in the case of nests with young, the opening was only 4.5 cm. in diameter.

The parents seem not to remove the dejecta from the nest.

Eggs.— *A. c. saturata:* Two or three. The ground-color varies from white or creamy-white to pale rufous and is sparingly marked all over with spots and dots of pale brown, light red, or dull maroon-red, which are more numerous towards the larger end, where they are often more or less concentrated into a zone.— Ogilvie-Grant, Ibis, 1909, p. 49.

Outer Primary.— .24 of length of wing, rather narrow; 8 to 12 mm. longer than primary coverts.

Pachyphantes.

Nest.— *P. superciliosus:* Does not nest in colonies, but builds usually on two tall stalks of grasses in or near marshes, at a height of five to ten feet, often making a second nest at a little distance, which serves as a roost for the male.

The nest which receives the eggs is roughly oval, a dozen centimeters from top to bottom, with a small round entrance on the side, high up. It bears a certain resemblance to that of *Amblyospiza* and is woven mostly of strips torn from a hairy grass, but its softness is increased by a lining of soft plant-down. (See Plate X.)

The empty nest is usually of more open texture, often incomplete, and has no soft lining. It may be finished before all the eggs are laid, or may only be commenced later. The tops of the grasses supporting the nests are stripped of seeds and often broken off by the birds.

Eggs.— *P. superciliosus:* Three to four, sometimes pale bluish green, thickly and finely spotted with grayish or dusky, sometimes bluish gray or gray-blue, unspotted.

Outer Primary.— Exceeds primary coverts, measures .27 of length of wing.

Ploceus.

Nest.— *P. baya:* Nest woven of strips from grass, plantain-leaf, and not infrequently of strips from the leaves of the date-palm or cocoanut; long, retort-shaped, with lower tube or entrance of variable length. Numbers of them are hung on palms, acacias or other trees, often overhanging a river or tank, or even from the end of a thatched roof. Clay is often put in the nest, possibly to balance it, sometimes as much as three ounces in six different spots (Jerdon).— Butler, Foreign Finches in Captivity, p. 313.

Eggs.— *P. baya:* Two or three; pure white (Jerdon).

Outer Primary.— *P. manyar:* 4 mm. longer than primary coverts; .22 of whole length of wing.

Ploceëlla.

Nest.— *P. javanensis:* A cylindrical structure, made entirely of grass with an opening at the side. The exterior of the nest, instead of being smooth as in the nests of the other Weaver-birds, is very rough, consisting of a series of loops and sharp angles. It is attached to several stalks of elephant-grass, or occasionally to a prickly tree.— Oates, Birds of British Burmah, p. 363.

Eggs.— *P. javanensis:* Two or three in number; varying very much in color; some are white, others are greenish white, gray, or purplish, and while some are unmarked, the majority are speckled with gray, greenish brown, or neutral tint.— Birds of British Burmah, p. 364.

Sitagra.

Nest.— *S. heuglini:* Nest typically Ploceine, without spout, woven of green grass and always lined with the white feathery flower-heads of a common grass (*Imperata cylindrica*); in small colonies, in trees near nests of *Buteo auguralis* and other birds of prey, or on bushes and reeds over water, or on thorn-trees (*Zizyphus*). Unlike most Weavers they breed in the dry season.

S. tænioptera: Globular, opening downward, without spout, hung in numbers on papyrus and tall reeds along streams, more rarely on lower branches of trees. Woven of grass and flower-stems of papyrus. (See Plate VIII.)

S. monacha: Suspended from tips of tall grasses in clearings or near water; peculiar in being woven partly of seed-bearing grassheads, as well as of strips from the leaves. They were rounded, without long spout.

S. luteola: Round nests, woven of strips of grass, and hung singly from the outer branches of thorny acacias. Old nests have long spouts.

Eggs.— *S. heuglini:* Two in set, light greenish blue, unspotted.

S. tænioptera: Two in set, varying from clear brown to light green, spotted with brownish.

S. monacha: Two or three, pure white.— Reichenow, Vögel Afrikas, III, p. 76.

S. luteola: Two, pure white.

Outer Primary.— *S. heuglini:* Only 2.5 to 3.5 mm. longer than primary coverts; .22 of length of wing.

S. tænioptera: Much longer, .31 of length of wing.

Hyphantornis.

Nest.— *H. cucullatus bohndorffi:* Abundant Weaver about villages, hanging its homes in scores or hundreds on palms or tall trees about villages. Nests rounded, with a slight downward-pointing tubular entrance, woven rather coarsely of strips torn from bananas or palms. (See Plate VIII.)

I have seen nests (Bumba, Dec. 12, 1914) built in a tree around a nest of *Gypohierax angolensis* as has already been recorded by Reichenow.

Eggs.— *H. cucullatus:* Two eggs found in a nest. They are of three types, *viz.* pure white; bluish green, sparingly marked all over with spots of umber-brown and blotches of lilac-gray, some of which are very pale; and lastly white, marked rather sparingly all over with small spots of dull maroon and pale gray.— Bates and Ogilvie-Grant, Ibis, 1909, p. 45.

Outer Primary.— Large, .29 of length of wing.

Melanopteryx.

Nest.— *M. nigerrimus:* Very similar to those of *Hyphantornis cucullatus bohndorffi;* typically Ploceine in shape, pensile and rounded, with entrance below, but without long spout. Builds in colonies in palms or tall trees, using strips torn from palm fronds, banana leaves or grass.

M. maxwelli: Like those of *M. nigerrimus*, and constructed of the same materials, for the birds are seen carrying strips of banana and palm leaves, and plucking other leaves to render its nests rainproof. Nests rather locally, in large trees near villages, sometimes in company with *Hyphantornis c. bohndorffi* and even *M. nigerrimus* and *Hyphanturgus aurantius.*

Eggs.— *M. nigerrimus:* Two, light blue.

Outer Primary.— .26 of length of wing.

Malimbus.

Nest.— *M. nitens:* Retort-shaped, with unusually wide "spout," woven and hung singly from the ends of boughs or creepers in open spaces in the forest, especially above streams, or on low branches projecting out over rivers.

M. erythrogaster: Round, well woven of pieces of thin vines, with a long spout, which is sometimes lacking, for it is probably added after the eggs are laid. One nest seen in the same tree with a nest of *Corythaeola cristata*, and a number in a tree recently occupied by *Spizaetus coronatus.*

M. coronatus: Hangs its nests singly to thorny acacia vines in forest. One nest collected was woven of spiral tendrils from some vine, with small dry twigs and leaf stems.

M. malimbicus: Nest hung from the long thorny rhachis of a Calamus or climbing palm, more roughly built than that of a *M. cassini,* and the downward pointing opening was short and ragged. The material seemed to be strips of the leaves of the palm on which it was hung.— Bates, Ibis, 1909, p. 41.

Eggs.— M. nitens: Brown speckled egg.— Bates, Ibis, 1909, p.

M. rubricollis centralis: An egg found in oviduct was white with a few rufous spots.

Outer Primary.— Longer than primary coverts, sometimes by as much as 18 mm.; .25 to .35 of length of wing.

Xanthophilus.

Nest.— X. xanthops: According to Boyd Alexander, "the tunnelled nests were hung from pendent branches of thick bushes near running water, and were never in colonies." — Shelley, Birds of Africa, IV, p. 485.

Eggs.— X. xanthops: The specimens examined by Mr. Nehrkorn were uniform bluish green, or spotted with light and dark gray.— Shelley, Birds of Africa, IV, p. 486.

Outer Primary.— .31 of length of wing.

Othyphantes.

Nest.— O. baglafecht: Builds its large, rather rough sac-like nest, not in colonies, of coarse green grass blades, on high trees, usually on stream banks, or at least not far from water (von Heuglin).— Reichenow, Vögel Afrikas, III, p. 41.

Eggs.— O. baglafecht: Two to four, the ground color varies between flesh-color and light blue-green, and they are sprinkled with rather large spots and points from rusty red to purplish brown (von Heuglin).— Reichenow, Vögel Afrikas, III, p. 41.

Outer Primary.— O. baglafecht: .32 of total length of wing.

Phormoplectes.

Nest.— P. herberti: A single nest found in the top of a small tree was composed almost entirely of grayish-green, moss-like lichen, bound together with strips torn from palm leaves, and fastened securely to the small branches, with entrance beneath, but not pensile, and without a "spout."

Eggs: Unknown.

Outer Primary.— P. herberti: Rather narrow, .23 to .24 of length of wing; and reaching only 4 or 5 mm. beyond the coverts.

Hyphanturgus.

Nest.— H. aurantius: Fond of rivers; usually hanging their round, coarsely-woven nests in colonies on bushes or trees over water.

H. ocularius: Retort-shaped, neatly woven of fine grass-strips, often with a long tubular entrance, wide enough to admit two birds at once. Hung singly from the ends of drooping boughs of thorny acacias. (See Plate IX.)

H. nigricollis: Woven of thin plant stems and a little grass, with a spout hanging down perhaps 20 mm. Suspended in trees, singly.

Eggs.— H. aurantius: Two, dirty whitish, faintly tinged with green, and finely speckled and blotched with brown; or light green, spotted with brown.

H. ocularius: Two, pale bluish with numerous small spots of brownish-gray.

H. nigricollis: Two, pale greenish blue, or white with small rufous spots. Reichenow describes them as grayish green with small lilac-gray and large gray-brown spots.

Outer Primary.— Exceeding primary coverts: .32 of length of wing.

Nelicurvius.

Nest and Eggs.— N. nelicourvi: Like many of their relatives they build in company; the nests, which are formed with art of stems of grass interlaced and even woven, have the form of a gourd, or rather of a retort, with long, slender neck, turned downwards, by which the bird enters. They are hung from thin flexible branches, so that they swing gracefully with the slightest breeze; and one can often count as many as thirty or forty on the same tree. The set is of four or five eggs, entirely green.— Histoire Naturelle des Oiseaux de Madagascar, I, p. 447.

Outer Primary.— Relatively long; .32 of wing.

Anaplectes.

Nest.— A. melanotis: Nests graceful and beautifully woven, suspended from twigs of high trees (Emin).— Birds of Africa, IV, p. 341.

Eggs.— A. melanotis: Uniform green.

A. rubriceps: Two, blue (Ayres); pale greenish blue (Guy Marshall).

Outer Primary.— Long, about .26 of wing.

Foudia.

Nest and Eggs.— F. madagascariensis: They do not build in society, and their nest has sometimes the form of a gourd with lateral orifice, sometimes that of a cup rather roughly fashioned of little roots and stems of grasses. The eggs, numbering four or five in a set, are of a pale greenish blue.— Histoire Naturelle des Oiseaux de Madagascar, I, p. 447.

Outer Primary.— F. madagascariensis: Much reduced, reaching only 1 or 2 mm. beyond the primary coverts. And yet the genus is usually placed in the neighborhood of *Ploceus*, in spite of this and other obvious resemblances to the Bishop Birds. The seasonal plumages of the male seem to be correlated with the open country they are said to frequent, whereas *Nelicurvius nelicourvi* and *Ploceus sakalava*, inhabiting the woods of Madagascar, undergo no such change. On the continent of Africa — in the same way — those Weavers showing markedly different breeding plumages are all birds of the open.

Brachycope.

Nest.— B. anomala: Nests about villages in coffee-bushes, small trees and young oil-palms, but not in colonies. Weaves well, but makes a lateral entrance reminding one of a Bishop Bird's nest.

Eggs.— *B. anomala:* Two, of a rather dark uniform gray.

Outer Primary.— *B. anomala:* Pointed, frequently exceeds primary coverts by only 2 or 3 mm.; measures only .14 to .17 of length of wing.

Foudia and *Brachycope,* in my judgment, are two excellent links between the most typical Weavers (*Ploceus,* etc.) and the Bishop Birds, groups which it is impossible to separate in distinct subfamilies.

Quelea.

Nest.— *Q. æthiopica:* In the gardens of Khartum, von Heuglin found them building their dainty, and rather shallow, purse-like nests of green grass blades artfully plaited, preferably on Parkinsonias; but they laid no eggs.— Vögel Afrikas, III, p. 110.

Q. cardinalis: Nests found in the high grass at Nuguruman by Fischer resembled those of *Pyromelana nigriventris.*—Vögel Afrikas, III, p. 112.

Q. quelea: The method of weaving, as observed by Dr. Butler in cage-birds (Foreign Finches in Captivity) is exactly the same as in the typical Weavers such as *Hyphantornis* and *Hyphanturgus.* "When building it always commences in the same way, forming either an oblique or perpendicular hoop of plaited hay or fibre, between two or more branches, or in the fork of a branch. From this hoop it works, starting from the bottom and gradually filling in the back, finishing off with the front, in the center of which it leaves a small hole to enter by."— Foreign Finches in Captivity, p. 229.

Eggs.— *Q. cardinalis:* Three (Fischer), grayish white, thickly and regularly spotted with purple and dark gray (Nehrkorn).— Vögel Afrikas, III, p. 112.

Outer Primary.— Minute and pointed, shorter than primary coverts.

Pyromelana.

Nest.— *P. flammiceps:* Well hidden in high grass, singly, woven of strips from grass blades, and lined with fine grass tips, but rather loosely constructed, so that sunlight penetrates from all sides. Attached to four or five slender stalks of grass and many of the adjacent blades. Entrance at side, high up. Bates (Ibis, 1909, p. 50) thinks that the use of grass-tops indicates Spermestine relationship, but even *Sitagra monacha* uses this material as a lining. I have not found nests set in forks. (See Plate IX.)

P. oryx: As a rule these birds nest in colonies, often of great extent, the nests, which are domed and woven out of grass, being attached to the stems of three or four reeds, about four or five feet above the mud or water.— Stark and Sclater, Birds of South Africa, I, p. 127.

Eggs.— *P. flammiceps:* Two or three, light greenish blue, with small scattered spots of purplish brown, most numerous about the larger end.

P. oryx: Four or five, uniform pale greenish blue in color.— Stark and Sclater, Birds of South Africa, I, p. 128.

Outer Primary.— Slightly shorter, equal to, or slightly longer than primary coverts, .13 to .16 of length of wing.

Coliuspasser.

Nest.— *C. macroura:* Built singly in high grass, well hidden, in shape and material exactly like those of *Pyromelana flammiceps.*

C. concolor: Spherical, woven loosely of strips of grass, lined throughout with grass-tops. These projected out over the circular entrance, which opened well up on one side.

Eggs.— *C. macroura:* Two, bluish green, rather heavily spotted.

C. concolor: Two, light bluish green, heavily spotted with dark greenish brown especially on the larger end.

Outer Primary.— Narrow, about equal to primary coverts.

Diatropura.

Nest.— *D. progne:* The nest is an oval domed structure with a side entrance, roughly woven out of fine grass, lined with the flowering tips of grass or reeds. It is generally placed a few inches off the ground, in the center of a tuft of grass, attached by its sides to many grass-stalks, the blades and tops of which are bent down and tied together to form an additional concealment and protection.— Stark and Sclater, Birds of South Africa, I, p. 141. See also W. E. Teschemacker, Avicultural Magazine, Third Series, I, p. 81.

Eggs.— *D. progne:* Usually four in number, white or bluish white, closely marked with small spots and dashes of dark brown and slate-gray.— Stark and Sclater, Birds of South Africa, I, p. 142.

Outer Primary.— Very short, only about .6 of the length of primary coverts.

Subfamily ESTRILDINÆ.

Spermestes.

Mouth of Young.— *S. cucullata:* Little swelling of the skin at gape; the interior of the mouth is largely yellowish, on the palate two black concentric horseshoe marks, around the tongue a black ring, and inside the mandible two curved black lines. The corners of the mouth are without papillæ or lobes, and whitish, the beak dark gray externally. (See Plate VI, 1.)

S. poensis stigmatophora: Very similar to the foregoing in color and pattern, as shown by Plate IV, 4.

Nest.— *S. cucullata:* A rough ball of seed-bearing grass-tips packed tightly together, with an opening at the side, not suspended, but firmly supported in forks in acacias, lemon, orange, mango and many other tree, between the bases of oil-palm leaves, close to the trunk beneath the eaves of grass-thatched houses, or even between the green fruit in growing bunches of plantains. Excrement of young not removed from nest by parents.

S. poensis stigmatophora: A covered globular nest, with dry leaves outside, and a lining of fine grass tips.

Eggs.— *S. cucullata:* Pure white, five or six in set.

S. poensis stigmatophora: Pure white — Reichenow, Vögel Afrikas, III, p. 153.

Outer Primary.— Narrow and pointed, shorter than primary coverts.

Amauresthes.

Mouth of Young.— *A. fringilloides:* Skin of gape not swollen into lobes, palate with a horseshoe-shaped yellow area, bounded inside by a black line, externally by a broader blackish area; a pair of black spots on the tongue, and a double black crescent beneath it on the mandible. (See Plate VII, 7.)

Nest.— *A. fringilloides:* Similar to that of *Spermestes cucullata*, round and covered, with opening at side, constructed of dry grass, lined with fine seed-bearing grass-heads.

Eggs.— *A. fringilloides:* Pure white, as many as six in set.

Outer Primary.— Narrow and pointed, shorter than in primary coverts.

Munia.

Mouth of Young.— That of a domesticated variety of *M. oryzivora* is described on page 247.

Nest and Eggs.— *M. oryzivora:* Sometimes at the summit of various trees, sometimes among the numerous creepers which cover the stems of the areng palms. They vary in size and form, according to their position; whilst those attached to trees are for the most part larger and possess, on the average, a fairly regular half ball-shaped form, those placed among creepers on the areng palms are smaller and of a less decided irregular form, only slightly hollowed out in the centre. All nests, however, are almost exclusively composed of the stalks of various grasses, which are not very firmly twined together, so that the whole build is of no great solidity. The number of the shining, white eggs varies between six and eight (Bernstein).— Foreign Finches in Captivity, p. 250.

Outer Primary.— Narrow, and shorter than primary coverts.

Parmoptila.

Mouth of Young.— *P. jamesoni:* Skin at corners of mouth black, bearing three small yellowish balls, interior of mouth yellow, five black spots on palate, and a black crescent beneath tongue.

Nest.— *P. woodhousei:* A large pile of dried leaves and grass, sometimes with moss, or a lining of fiber from dry plantain leaves, with entrance at side, supported on a horizontal branch.— Bates, Ibis, 1908, p. 324; 1909, p. 67.

Eggs.— *P. woodhousei:* Pure white, three to four.— Bates, Ibis, 1909, p. 67.

Outer Primary.— Narrow and pointed, shorter than primary coverts. (See Fig. 1, D.)

Nigrita.

Mouth of Young.— *N. canicapilla:* Four whitish papillæ in each corner of mouth, palate spotted with black.

N. brunnescens saturatior: Markings similar to those of *N. canicapilla*, five black spots on palate, posterior pair small, and a black crescent beneath the tongue.

N. luteifrons: Margin of gape black, with four white warts or wattles, one just at the angle of the gape, two above and one below this, there were spots on the palate and tongue like those of *Estrilda.*— Bates, Ibis, 1911, p. 592.

N. fusconota: Mouth-markings like those of *Estrilda.*— Bates, Ibis, 1911, p. 593.

Nest.— *N. canicapilla:* A rough, bulky mass of dry grass (not woven), dead leaves, and a little soft bark or green moss, with entrance at side, supported on leafy branches. Nest not cleaned of excrement.

N. brunnescens: Much like that of an *Estrilda*, but larger and composed of a loose mass of dried leaves, lined with a more compact structure of grass-tops, placed in a forked twig of a small tree.— Bates, Ibis, 1911, p. 592.

N. fusconota: A rough mass of brownish vegetable material, not woven in the least. Fine shreds of bark, dry grass, dry leaves, and a little moss used in its construction. A great deal of dried excrement in the bottom.

Eggs.— *N. canicapilla:* Pure white, four in set.

N. brunnescens: Five perfectly white eggs.— Bates, Ibis, 1911, p. 592.

Outer Primary.— Narrow and pointed, equal to or a little shorter than primary coverts. (See Fig. 1, E.)

Clytospiza.

Mouth of Young.— *C. monteiri:* Palate yellow, with five black spots, tongue flesh-color, with a dusky band across it, a blackish crescent on mandible beneath tongue. Soft skin at sides of mouth considerably swollen, but constricted at corners, so as to present a bilobate appearance. This is whitish externally, but yellow inside, with two black spots. (See Plate VI, 2.)

Nest.— *C. monteiri:* Uses abandoned nests of other birds, Weaver-finches, Coucals, and the like, adding a slight lining of matted hair and pieces of snake skin. Nest not cleaned by parents.

Eggs.— Pure white, six in set.

Outer Primary.— More than twice as long as the primary coverts, not pointed (See Fig. 1, C.)

Spermospiza.

Mouth of Young.— *S. poliogenys:* Has spotted palate characteristic of young Estrildinæ, but the two posterior marks have disappeared, leaving only three rather large dusky spots on the yellowish palate. There is a dusky ring around tongue, broken above, and a dark crescent beneath the tongue.

S. guttata has the same number of spots, but no marks on tongue. (See Plate VI, 6.)

In neither of these forms were the specimens young enough to show the wattles at the gape, but a dried skin of another young *S. ruficapilla* shows such wattles, the same in number and position as in *Pyrenestes ostrinus.*

Nest.— *S. guttata:* Loose globular piles of ferns with a central portion of grass-tops, in shape like those of *Estrilda,* with an opening at the side, some soft white pappus was placed inside for lining, and in one case some feathers that were not the bird's own.— Bates, Ibis, 1911, p. 588.

Eggs.— *S. guttata:* White, devoid of gloss, three in set.— Bates, Ibis, 1911, p. 588.

Outer Primary.— Projecting about three times as far as the primary coverts, measuring .39 of total length of wing.

Pyrenestes.

Mouth of Young.— *P. ostrinus:* At each side of the mouth there are three little fleshy balls placed in an oblique line. The uppermost is like the interior of the mouth, rather bright yellow, the two lower are whiter, and between these two there is a small additional papilla, pale yellow. Between the first and second, as well as at the base of the third, there is a little black color in the skin. Five black spots on the palate, the posterior pair very small. A dusky ring nearly encircles the tongue, and beneath it, on the mandible there is a black crescent. (See Plate VI, 3.)

P. o. gabunensis: Exactly the same, but the bill much smaller.

Nest.— *P. ostrinus:* A large globular mass of dry, broad strips of leaves of the *Calamus* palm, laid or woven together loosely, with an opening at one side, and lined with a few fine grass-tops.— Bates, Ibis, 1911, p. 588.

Eggs.— *P. ostrinus:* Three, white, without gloss.— Bates, Ibis, 1911, p. 589.

Outer Primary.— Narrowly pointed, about equal to primary coverts in length.

Amadina.

Mouth of Young.— *A. fasciata:* Waxy skin-glands white, later blackish blue.— Foreign Finches in Captivity, p. 185.

Nest.— *A. erythrocephala* has been observed using old nests of Sparrows and Weavers (*Sitagra velata*), after relining them with feathers. The clutch consists of four white eggs. No nest was found which they had constructed throughout.— Austin Roberts, Journal S. Afr. Orn. Union, 1906, p. 10.

Outer Primary.— Very narrow, 3 to 6 mm. shorter than the primary coverts.

Hypargos.

Mouth of Young.— *H. schlegeli:* Five dusky spots on the whitish palate, two on the tongue. Throat flesh-color, wattles at gape bluish white, with two spots near their bases. (See Plate VII, 10.)

Nest and Eggs.— Unknown.

Outer Primary.— *H. schlegeli:* Very small, much shorter than primary coverts.

Pytilia.

Mouth of Young.— *P. phœnicoptera emini:* Evidently of Waxbill type, but spots on palate obliterated. Roof of mouth, whitish anteriorly, becomes bright rose-color posteriorly, with a rather large, lighter and bluer spot at each side. Tongue flesh color at tip, rosy at base. Skin of gape bilobate as in *Clytospiza monteiri*, but a little less swollen, and bluish white in color, with two black spots at each side, in the same position. The rosy color of the interior of the mouth depends much on the blood, and fades rapidly after death. (See Plate VII, 8.)

Nest.— *P. p. emini:* Not woven, composed almost entirely of fine seed-bearing grass-heads, with a few feathers and some old crumpled blades of dry grass. Very dirty, excrement not removed.

P. melba belli: Domed and composed of fine grass and the down of some flower, the entrance was a small hole on one side close to the top.— Woosnam, Trans. Zool. Soc. London, XIX (1910), p. 292.

Eggs.— P. phœnicoptera: According to Kuschel the eggs are white.— Reichenow, Vögel Afrikas, III, p. 161.

P. p. emini: Egg from oviduct pure white.

Outer Primary.— Narrow and pointed, much shorter than primary coverts. Ninth primary emarginate towards tip.

Lagonosticta.

Mouth of Young.— L. rara: Tongue and palate cream color; throat flesh-color; five black spots on palate, lateral two largest; a blackish band, nearly divided into two spots, crosses the tongue; beneath this on the inside of the mandible, a black crescent. Skin at the corners of the mouth slightly swollen and purplish red, bearing two little white balls at each side, one close to the maxilla, the other near the mandible. (See Plate VII, 11).

L. rhodopareia: Five black spots on whitish palate, skin of gape with wattles, blue and white.— According to Swynnerton's Plate, Ibis, 1916, Pl. VII, p. 264.

Nest.— L. rara: A loose ball of soft seed-bearing grass-tops and feathers of a francolin with some dry grass-blades around the outside. Placed low down in a clump of grass.

L. brunneiceps: The simple nest, or often several together, is placed under rafters, in holes in walls in crevices about windows. A great irregular accumulation of grass blades forms the foundation for the small flat nest-cup, which is constructed of horsehair, feathers, grasses, wool and the like (von Heuglin).— Reichenow, Vögel Afrikas, III, p. 197.

L. rendalli: Placed in a small bush close to the ground. The nest was domed and composed of pieces of Indian corn-blades, and lined with fine grass-bents and Guinea-fowl feathers (Alexander).— Birds of Africa, IV, p. 261.

Eggs.— L. rara: Pure white, four in nest.

L. brunneiceps: Pure white, varying from three to seven (von Heuglin).— Vögel Afrikas, III, p. 197.

Outer Primary.— Narrow, pointed, about equal to primary coverts. Ninth primary emarginate.

Sporæginthus.

Mouth of Young.— S. subflavus: Five small black dots on the palate, two more on the back of the tongue, and a crescent on the mandible beneath it. (Skin of gape no longer swollen in this specimen).

Nest.— S. subflavus: On two occasions they adapted the nest of a totally different species to their needs. One pair took over an old nest of *Prinia mystacea* and lined it with flowering grass-heads, fitting a tubular entrance with the same material. — Van Someren, Ibis, 1916, p. 422.

Eggs.— S. subflavus: Pure white, four to six.— Van Someren, Ibis, 1916, p. 422.

Outer Primary.— Pointed, about equal to primary coverts, sometimes 2.5 mm. longer.

Estrilda.

Mouth of Young.— *E. astrild minor:* Five blackish spots on the flesh-colored palate, two on the tongue, and a black crescent beneath it, with bluish white swellings at the gape, in the form of a curved ridge and two little balls, separated by black skin, at each side. (See Plate VII, 9.)

E. nonnula: Five black dots on the pale yellow palate, two blackish spots at sides of tongue, towards base, and a small black crescent beneath it. Skin at corners of mouth black with two swollen curved lines, bluish white in color, at each side. (See Plate VII, 12.)

E. atricapilla: Mouth markings resemble those of the other species of Estrilda.— Bates, Ibis, 1911, p. 595.

E. melpoda: Mouth markings as in *E. a. minor.*— See figure, Bates, Ibis, 1911, p. 394.

Nest.— *E. a. minor:* Pyriform, with entrance at end, the nest material protruding around it as a short spout. Built entirely of seed-bearing tips of grasses not really woven, but put together very compactly and placed in a fork of a bush. Faeces not removed from nest.

E. astrild massaica: Two nests usually found side by side or one on top of the other; one only is used by the nesting bird, the other is simply a blind.— Van Someren, Ibis, 1916, p. 421.

E. nonnula: Rounded or oval, made of grass-tops, which stick out around the lateral entrance.

E. atricapilla: Nests of water-bottle shape, sometimes double, one part empty.— Bates, Ibis, 1909, p. 53.

Eggs.— *E. nonnula:* Pure white, four in set.

E. atricapilla: White, five in set.— Bates, Ibis, 1909, p. 53.

Outer Primary.— Narrowly pointed, often equal to primary coverts, but more frequently a little longer.

Nesocharis.

Mouth of Young.— *N. capistrata:* Five dark spots on palate, a dusky band across tongue. The little papillæ at the corners of the mouth were of the same shape and number as in *Estrilda astrild minor*, pale bluish green, backed up by black skin, but the upper edges of the mandible were not so light.

Nest and Eggs.— Unknown.

Outer Primary.— In *N. capistrata* often 3 mm. longer than the primary coverts, and not very sharply pointed.

Uræginthus.

Mouth of Young.— *U. bengalus:* The skin at the corners of the mouth has a swollen blue spot at each side. The throat is flesh-color, tongue and inner wall of mouth whitish with three black spots on palate, a narrow blackish ring around the tongue, and a black crescent beneath it, on the inside of the mandible, the ends of this crescent continuing back as dark lines to the angles of the mouth. (See Plate VI, 5.)

Nest.— *U. bengalus:* Closed above, with lateral entrance, built of soft seed-bearing grass-heads, not woven and rough on the outside. One had a few feathers for a lining. Placed in forks of small trees, in one case close to a nest of large wasps (*Belonogaster*). (See Plate X.)

Another pair used an old nest of *Sitagra luteola*, without even adding a lining.

Eggs.— U. bengalus: Pure white, three or four in set.

Outer Primary.— Shorter than primary coverts, and pointed.

Poephila.

Mouth of Young.— P. gouldiæ: "Besides some bars on the tongue and palate, there were three bright little rounded warts, like beads, at the angle of the mouth. Two were emerald-green and one blue, and they all had a pearly or opalescent lustre." (The figure shows five *spots* on the palate and a bar across the tongue).— Sharpe, Wonders of the Bird World, p. 115. See also Butler, Avicultural Magazine, 1898, Vol. V, p. 27.

Nest and Eggs.— P. gouldiæ and indeed all the Weaver-finches of Australia build in the typical Estrildine style. In "Birds of Australia" by Lucas and Le Souëf, we read: "The nests of all the Finches (Ploceidæ) are dome-shaped and remarkably bulky, composed of grasses with long spout-like entrances, and placed in saplings or bushes. Clutch five or six white eggs." This agrees with Gould (Introduction to the Birds of Australia, 1848, p. 52). "All the species build, I believe, large grassy nests, with a spout-like opening."

In captivity at least, *P. gouldiæ* does not clean the nest. "Owing to its domed construction and the height of the aperture above the heads of the young, it was impossible for the latter to have ejected their excreta outside; and the parents did not help them after the manner of so many birds" (Reginald Phillips).— Foreign Finches in Captivity, p. 172.

Outer Primary.— P. gouldiæ: Very small and narrow, much shorter than primary coverts.

Hypochera.

Mouth of Young.— H. ultramarina: Skin at corners of mouth pink, but no longer showed any swelling in our specimen. Interior of mouth whitish, with five dusky spots on its roof, two on the back of tongue, and a black crescent on the inside of the mandible beneath the tongue.

Nest.— H. ultramarina: Under rafters and gables, and in holes in walls. They consist, like those of the House Sparrow, of a great but nevertheless well arranged accumulation of grass, rags, cotton, and feathers, the shallow nest-chamber finely lined with hair, threads and the like (von Heuglin).— Reichenow, Vögel Afrikas, III, p. 214.

Eggs.— H. ultramarina: Pure white, three to five (von Heuglin).— Reichenow, Vögel Afrikas, III, p. 214.

H. chalybeata: White, three in number.— Van Someren, Ibis, 1916, p. 426.

Outer Primary.— Shorter than primary coverts, pointed.

Vidua.

Mouth of Young.— V. serena: Like that of young *Hypochera*, with five dark spots on the palate.

Nest.— *V. serena:* An openly woven, domed nest in a thick grass tuft, only a few inches from the ground.— Stark, Birds of South Africa, I, p. 147.

As Mr. van Someren says (Ibis, 1916, p. 427) "Much still remains to be found out regarding this bird's nesting habits." Both von Heuglin (Vögel Afrikas, III, p. 220) and Boyd Alexander (From the Niger to the Nile, II, p. 33) have surely been completely mistaken. This Whydah is common and widely distributed, but it must have a very short breeding season — in my experience, during the latter part of the rainy season — and hides its nest most successfully.

Perhaps indeed, as reported by Mr. Austin Roberts (Journal South African Ornithologists' Union, 1907, p. 9), it lays its eggs in nests of *Estrilda dufresni* and *E. astrild.* These eggs are said to be white, but the statement that the young differ from the young Waxbills in not having white spots at the gape adds an element of doubt. Such a habit would at least explain the present lack of knowledge about the nesting of a bird otherwise so well known.

Eggs.— *V. serena:* Pure white (Bocage).— Vögel Afrikas, III, p. 221. Nehrkorn is probably mistaken in describing them as grayish white with dark spots.

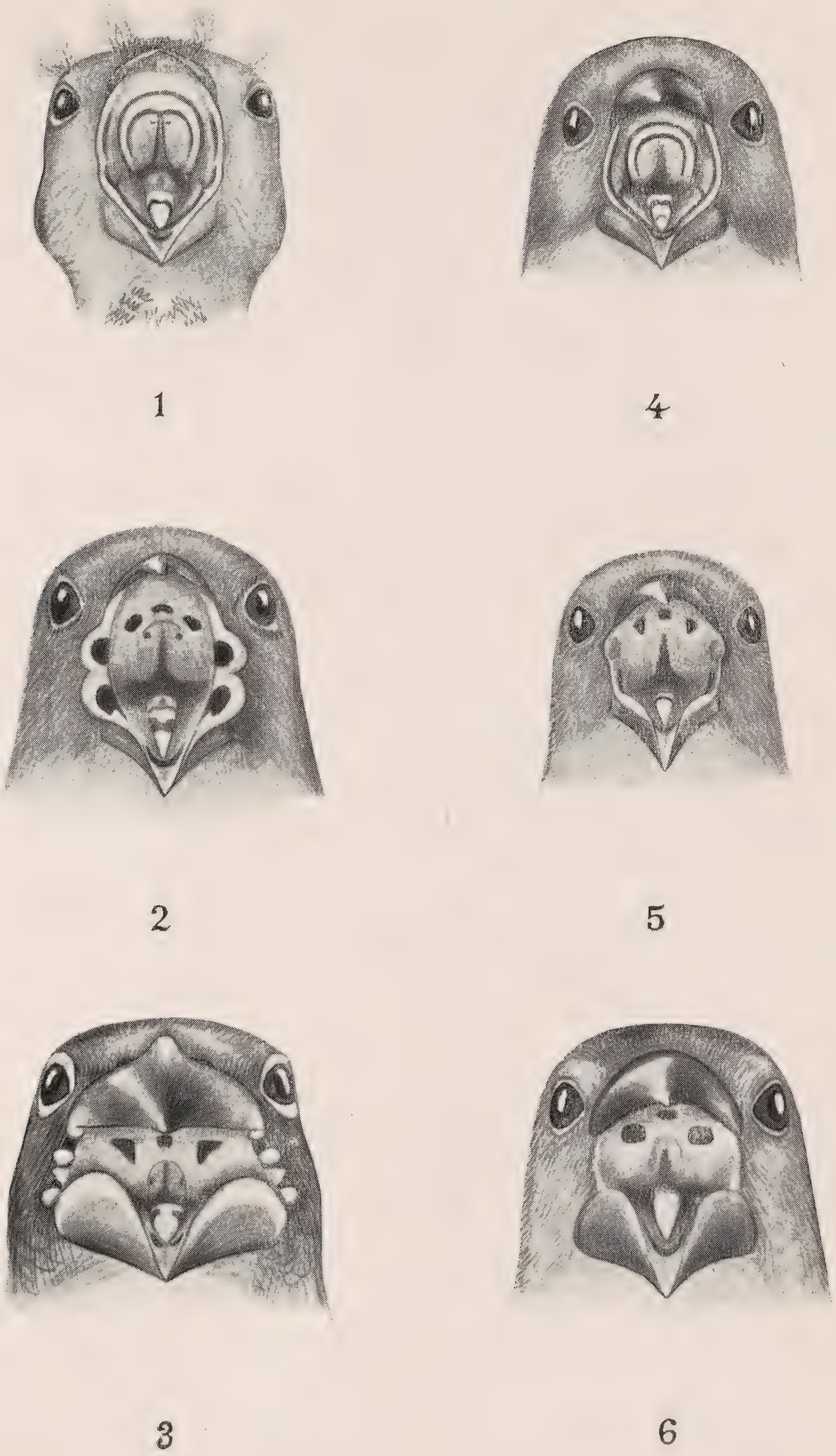
Outer Primary.— Very narrow and pointed, shorter than primary coverts.

Steganura.

Nest.— *S. paradisea:* Apparently unknown, save in captivity. Described by Dr. Russ as an extraordinary nest....one cavity shaped like a baker's oven, roofed over and neatly rounded off, with fibres and long horse-hairs; the other a flat, loosely compacted hollow, the hinder margin of which scarcely stood up at all.— Foreign Finches in Captivity, p. 273.

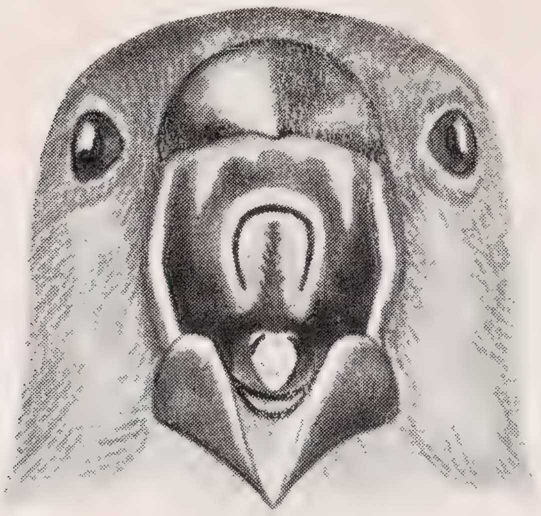
Eggs.— *S. paradisea:* Dr. Russ failed to find the egg, but in Shelley's Birds of Africa (IV, p. 29) it is described as "grey, so very closely spotted with black that the pale ground color is scarcely visible." In my opinion this needs confirmation.

Outer Primary.— Decidedly shorter than primary coverts, narrow and pointed.

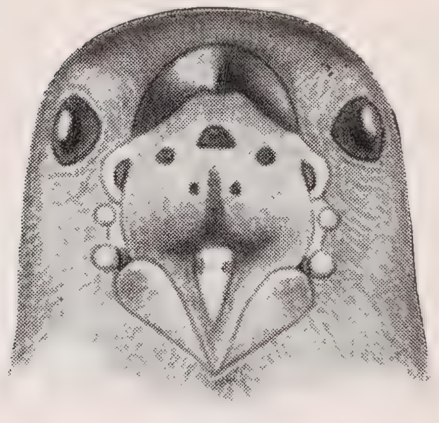


Mouth-markings in Young Weaver-Finches, drawn by the author from field sketches and specimens in alcohol.

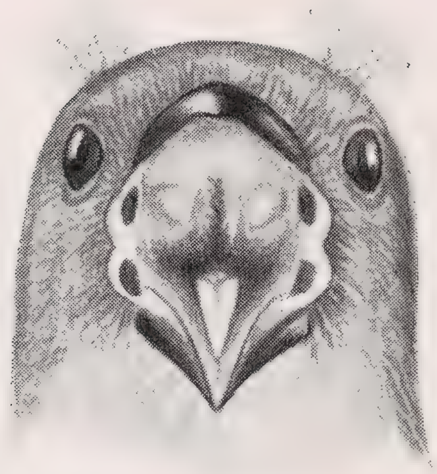
1. *Spermestes cucullata.* × 3. 4. *Spermestes poensis stigmatophora.* ×2.
2. *Clytospiza monteiri.* × 2. 5. *Uræginthus bengalus.* × 2.
3. *Pyrenestes ostrinus.* × $\frac{3}{2}$. 6. *Spermospiza guttata.* × 2.



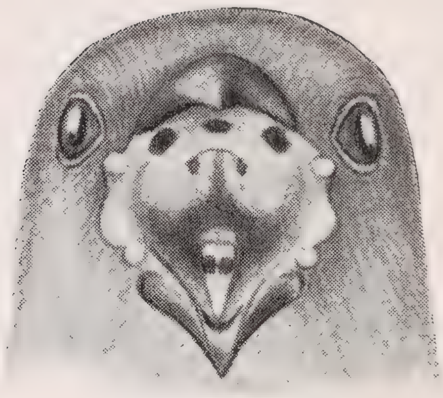
7



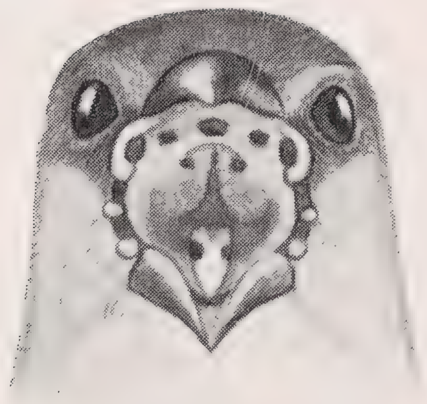
10



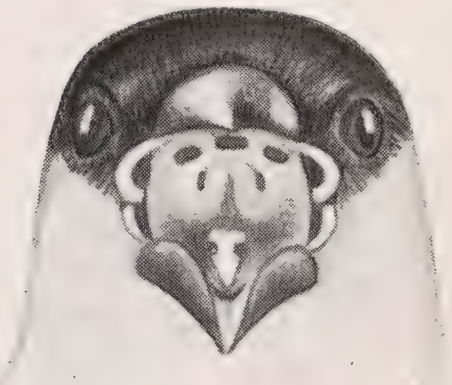
8



11



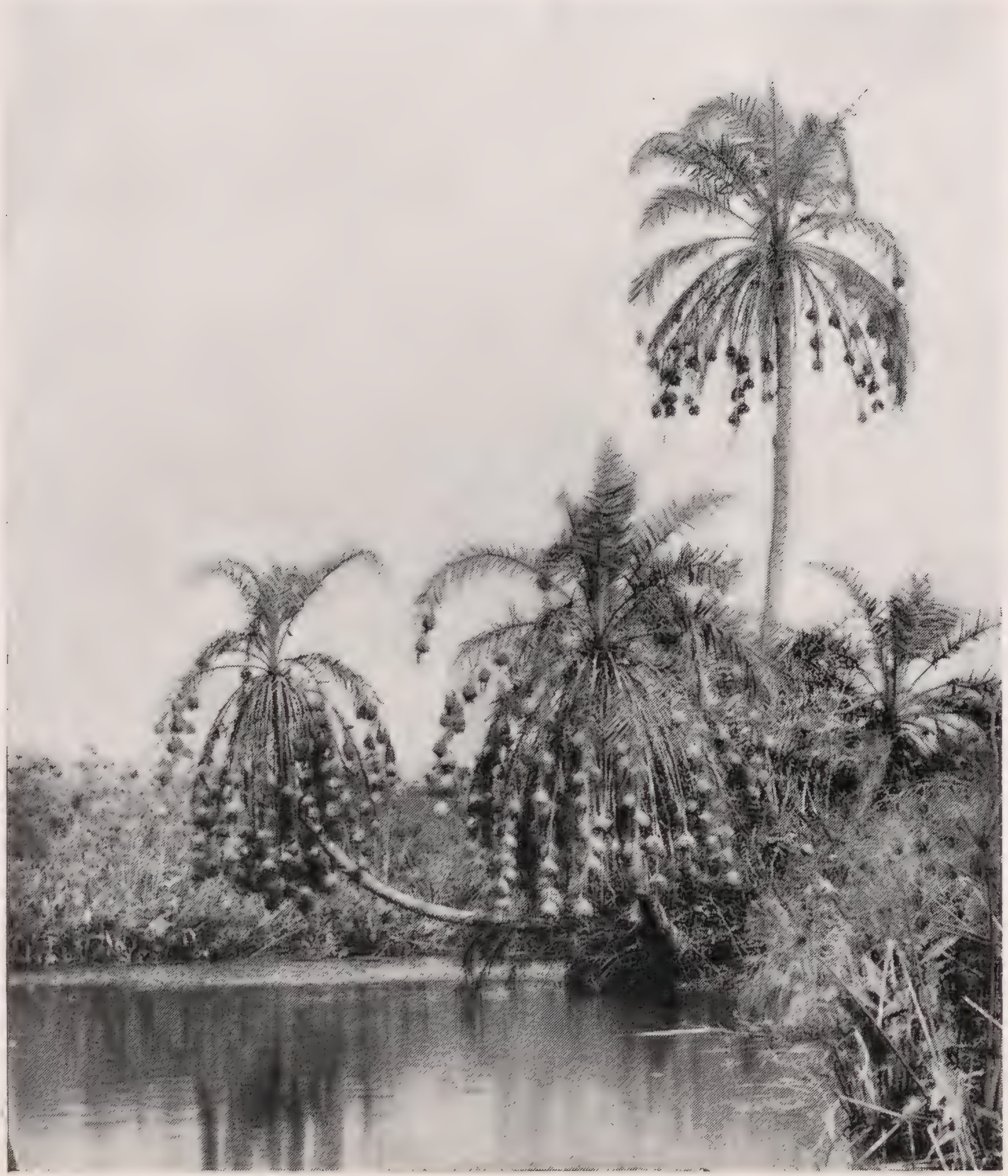
9



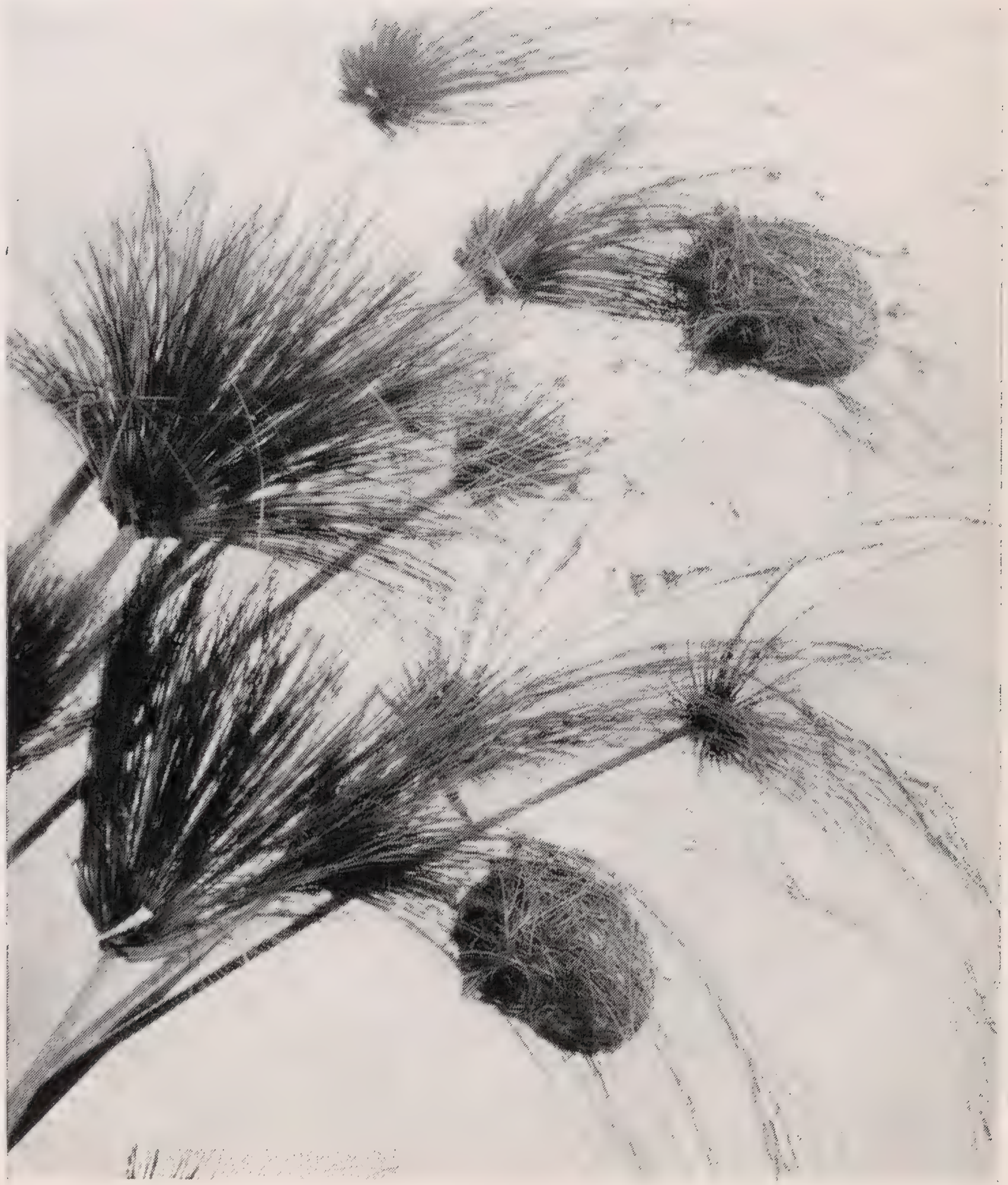
12

Mouth-markings in Young Weaver-Finches.

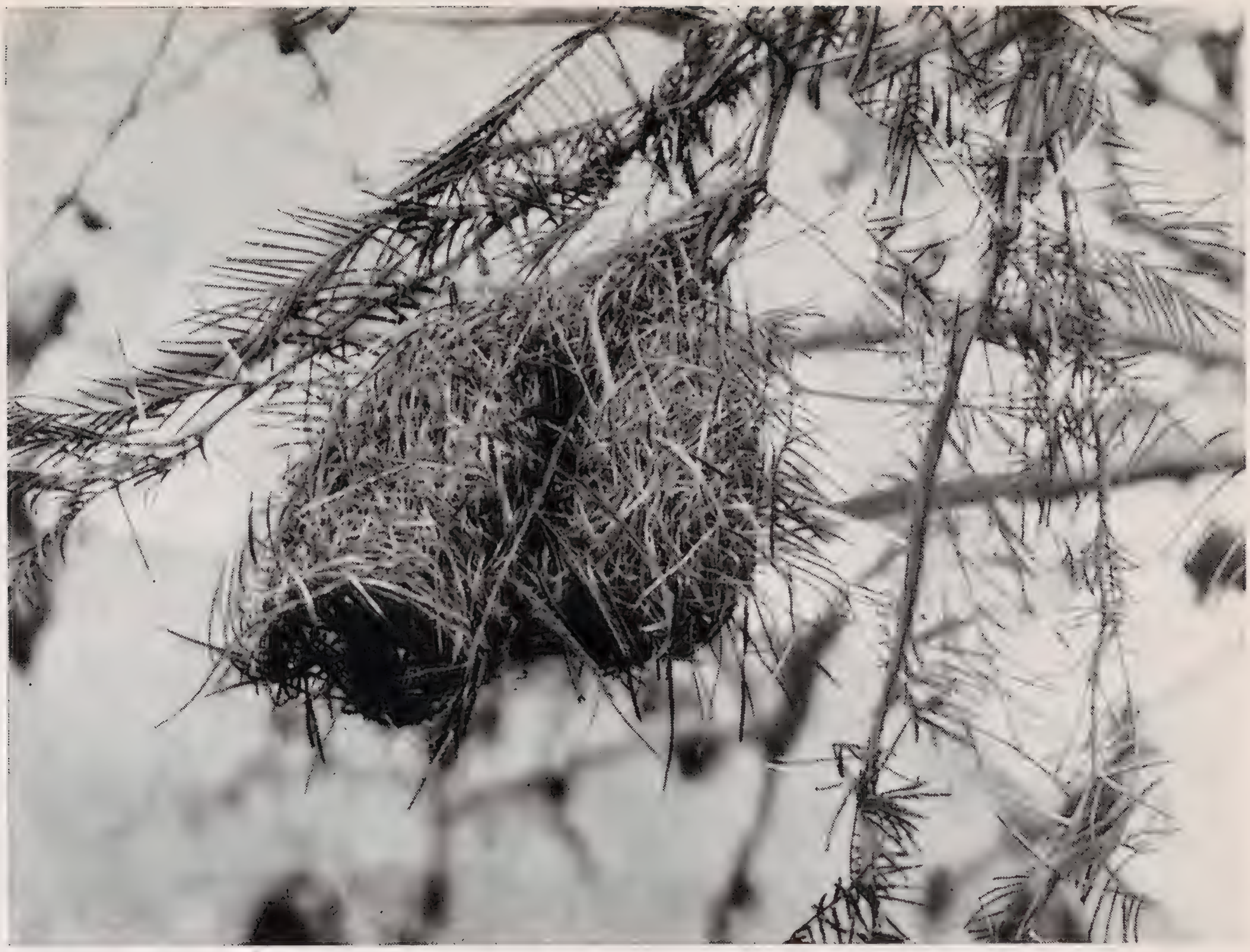
7. *Amauresthes fringilloides.* × 2.
8. *Pytilia phœnicoptera emini.* × 2.
9. *Estrilda astrild minor.* × 2.
10. *Hypargos schlegeli.* × 2.
11. *Lagonosticta rara.* × 2.
12. *Estrilda nonnula.* × 2.



Nests of *Hyphantornis cucullatus abyssinicus*, on wild date-palms (*Phœnix reclinata*), over water. Near Yakuluku, Belgian Congo. Oct., 1911. This and following photographs by Herbert Lang.

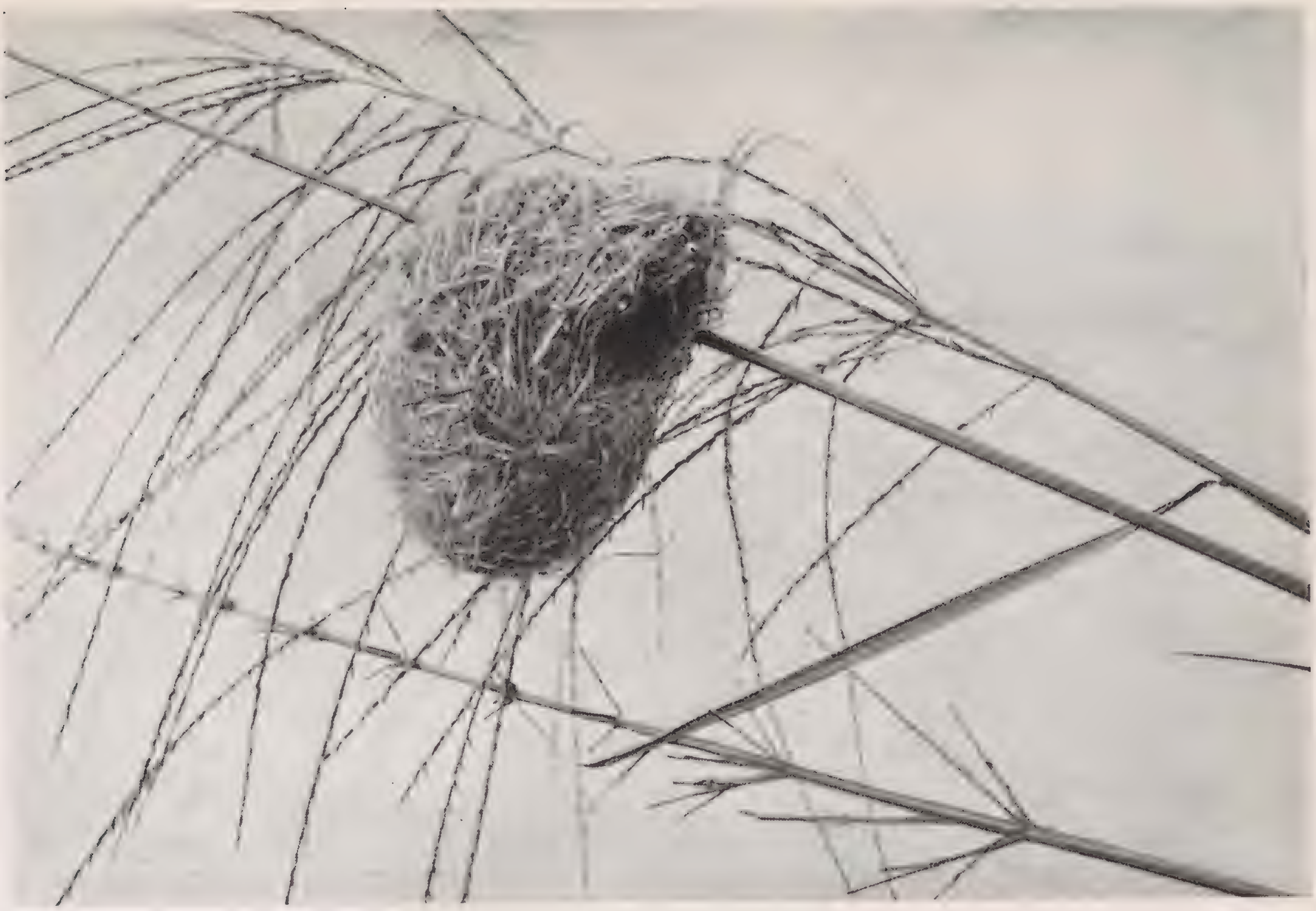


Nests of *Sitagra tænioptera* on *Cyperus Papyrus*, overhanging water. Faradje. Belgian Congo, Oct., 1912.

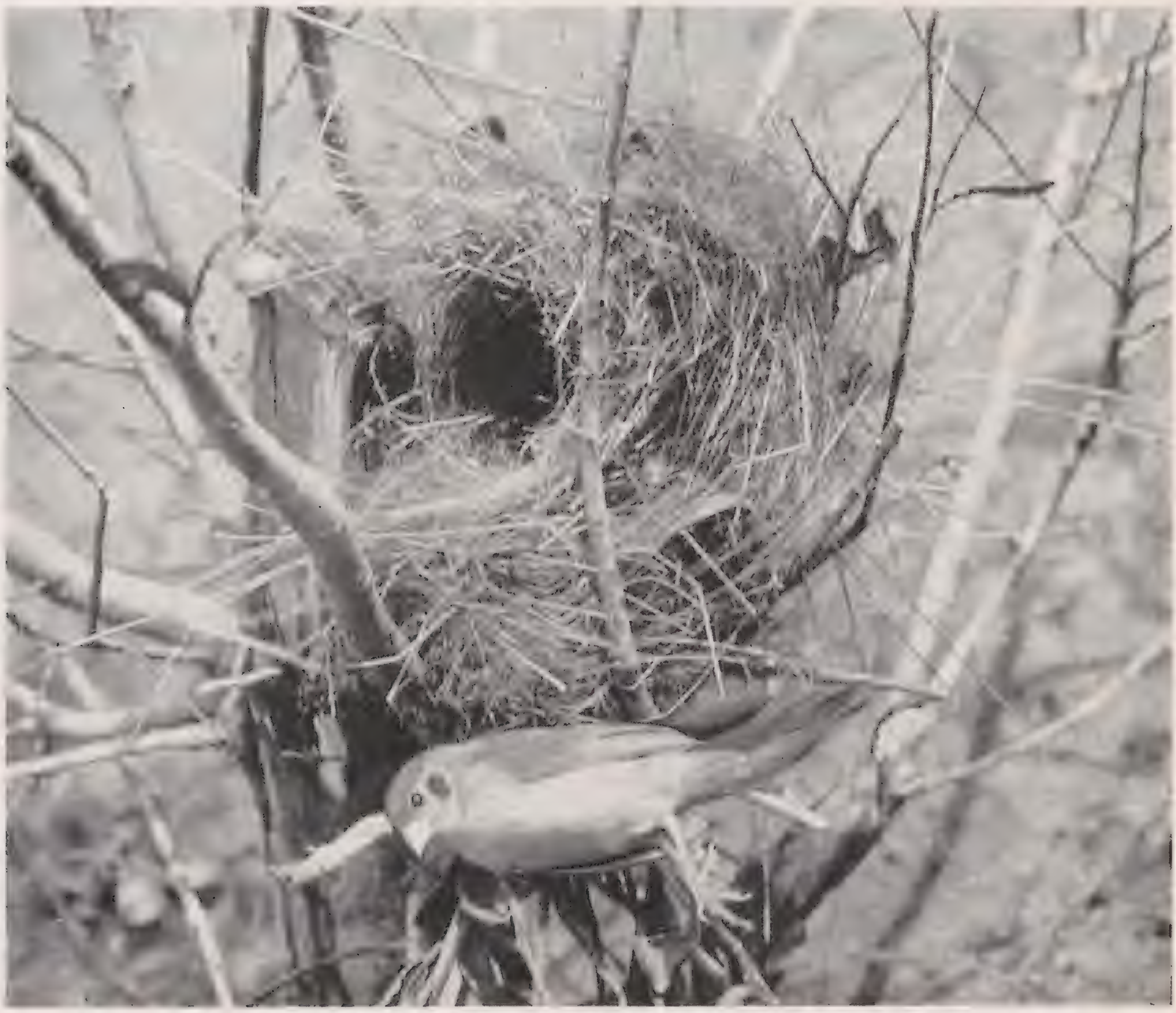


Typical Weaver nest, built by *Hyphanturgus ocularius*, on a thorny *Acacia*. The entrance opens directly downward. Faradje, Sept., 1912.

Nest of a Bishop-Bird (*Pyromelana flammiceps*), hung in tall grass: materials well woven, Faradje, Oct., 1912.



Nest of *Pachyphantes superciliosus*, with lateral entrance like that of a Bishop-Bird. Faradje, Sept., 1912.



Nest of a Weaver-Finch (*Uræginthus bengalus*), composed of grass-tops, not woven. Faradje, Sept., 1912.

56.81.9:14.71

Article X.— A COMPLETE SKELETON OF THE HORNED DINOSAUR MONOCLONIUS, AND DESCRIPTION OF A SECOND SKELETON SHOWING SKIN IMPRESSIONS.

By Barnum Brown.

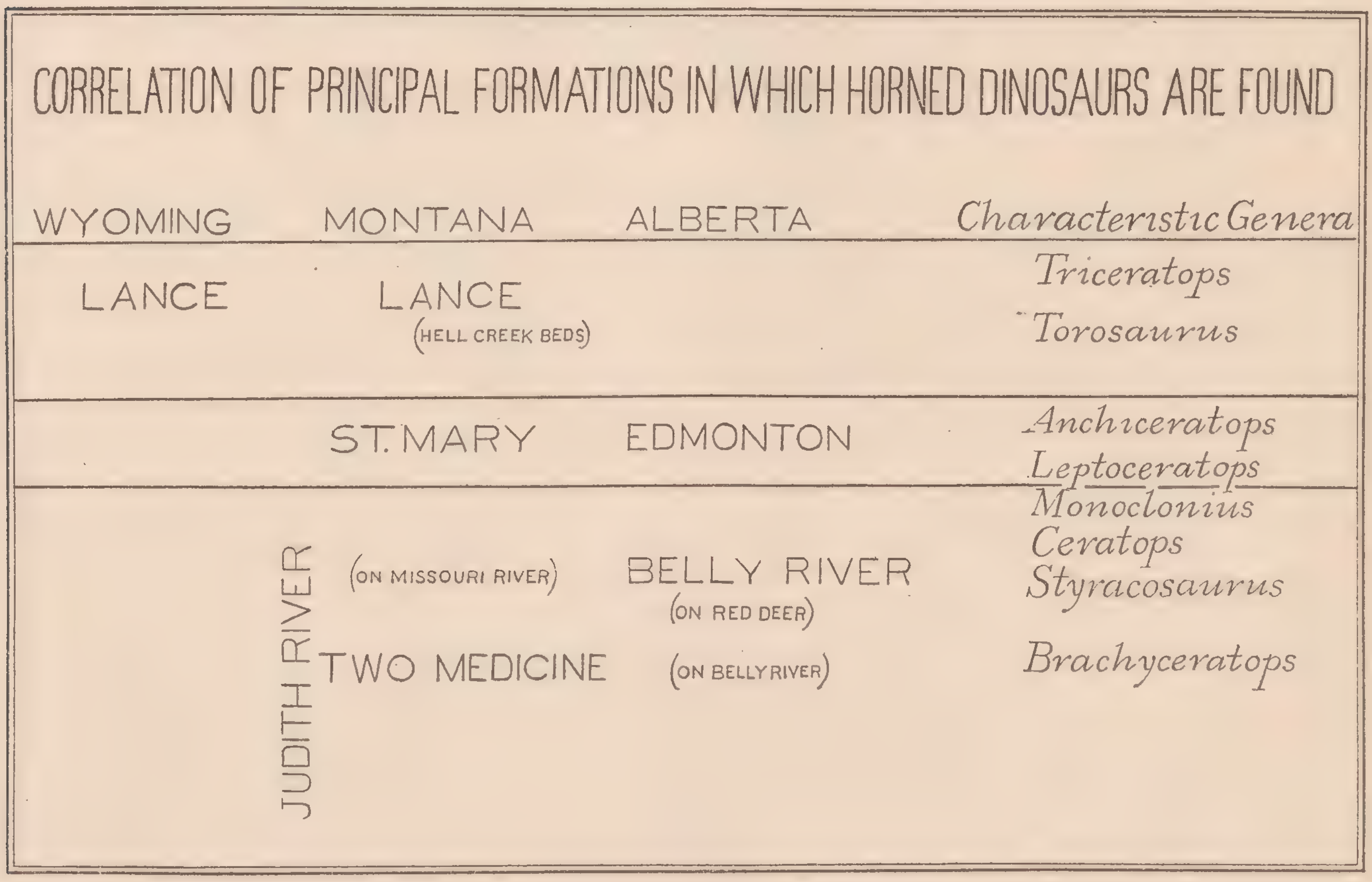
Plates XI–XIX.

Introduction.

Systematic search in the Upper Cretaceous formations of the western United States and Canada rarely fails to reveal some fossils referable to the Ceratopsia. Their remains are abundant in the Lance, the Judith River, the upper part of the Belly River, and are fairly numerous in the Edmonton.

At the present writing no genus of the Ceratopsia is known to be common to any two distinct formations, hence they are excellent horizon markers where determinations are possible.

In the Lance formation *Triceratops* is by far the most common vertebrate fossil known. During seven years' work, 1902–1909, in the Hell Creek Beds (Lance) of Montana I identified no less than five hundred fragmentary



CORRELATION OF PRINCIPAL FORMATIONS IN WHICH HORNED DINOSAURS ARE FOUND

WYOMING	MONTANA	ALBERTA	*Characteristic Genera*
LANCE	LANCE (HELL CREEK BEDS)		*Triceratops* *Torosaurus*
	ST. MARY	EDMONTON	*Anchiceratops* *Leptoceratops*
	JUDITH RIVER (ON MISSOURI RIVER)	BELLY RIVER (ON RED DEER)	*Monoclonius* *Ceratops* *Styracosaurus*
	TWO MEDICINE	(ON BELLY RIVER)	*Brachyceratops*

Fig. 1. Correlation Diagram.

skulls and innumerable bones referable to this genus. *Torosaurus,* the only other described Ceratopsian, is rare.

In the Edmonton, the next preceding formation, which contains a vertebrate fauna distinctly older than that of the Lance, Ceratopsian remains are less common. But it must be remembered that exposures of the Edmonton, for the most part confined to river banks, are less extensive than the Lance. *Triceratops* and *Torosaurus* are not present but the family is represented by two known genera, *Anchiceratops* a large animal of primitive skull characters, fairly common, and a small aberrant Ceratopsian *Leptoceratops* known from the type specimens and from a fragmentary skeleton soon to be described, from the St. Mary, a formation of synchronous age in Montana.

The Judith River formation of Montana and the Belly River formation of Canada are now generally considered to be equivalent in age. This I am convinced is only in part true, for the Belly River formation is certainly not a unit but is composed of two or more subdivisions that differ lithologically and faunally and which may eventually be given the rank of distinct formations. The upper part of the Belly River strata exposed on the Red Deer and the Saskatchewan Rivers and on Milk River where it again enters Montana, roughly the area north and east of the Sweet Grass Hills, is rich in vertebrate fossils. These strata are synchronous with the Judith River formation on Milk River and on the Missouri River at the mouth of Judith River and the vertebrate fauna is apparently the same. Ceratopsian remains are abundant and the genera and species are varied. *Monoclonius* and *Ceratops* are common to the designated Montana and Canadian areas. *Styracosaurus,* a rare form, is known only from the Belly River exposures on the Red Deer.

The Two Medicine formation of Montana differs materially in lithologic characters from the strata before mentioned and contains a varied fauna that appears to be older. These strata check perfectly with the typical Belly River exposed on Belly River between the mouth of the St. Mary and the Little Bow and are doubtless synchronous in age. In the Two Medicine, where the vertebrate fauna is best known, Ceratopsians are not abundant and so far only one form has been described, *Brachyceratops,* a small primitive genus not known from any later horizon.

Physical conditions that existed during deposition of the Belly River and the Edmonton strata appear to have been similar and these formations both show a gradual change from purely marine beds at the base up through brackish-water to fresh-water beds at the top. The Lance formation is more uniformly a fresh-water land deposit.

Frequently remains of many Trachodonts are found massed together in

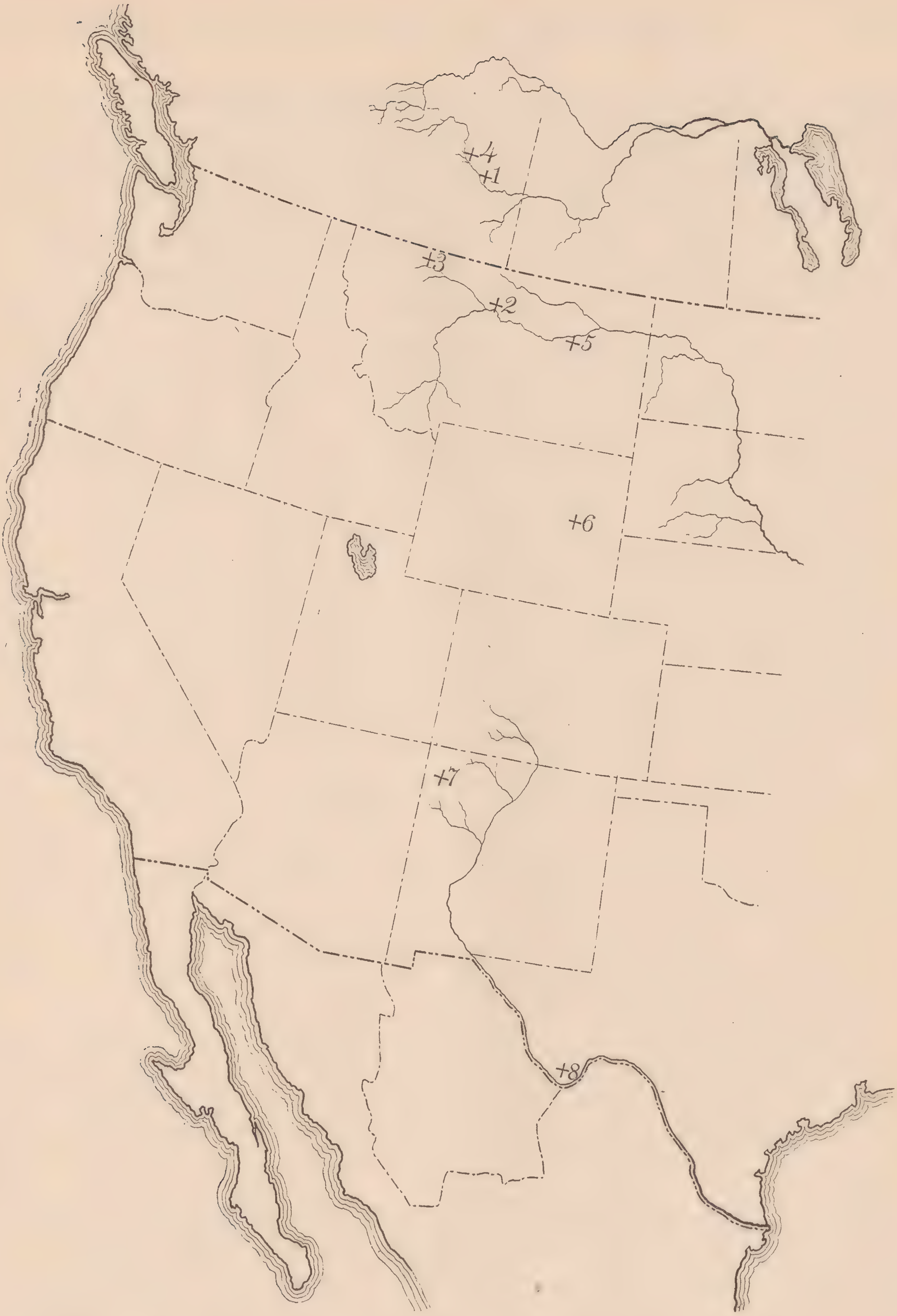


Fig. 2. Sketch map showing principal areas in which horned dinosaurs are found.

1 = Belly River formation on Red Deer River, Alberta.
2 = Judith River " " Missouri River, Montana.
3 = Two Medicine " " Blackfeet Indian Reservation.
4 = Edmonton " " Red Deer River, Alberta.
5 = Lance (Hell Creek Beds) formation on Missouri River, Montana.
6 = Lance formation, Converse Co., Wyoming.
7 = Ojo Alamo Beds, New Mexico.
8 = Rattlesnake Beds, Big Bend of Rio Grande, Texas.

quarries, probably as a result of water action, in the Belly River and in the Edmonton strata, and there are two records of such occurrence in the Lance. In such quarries it is not exceptional to find Trachodonts, carnivorous dinosaurs, Ceratopsia and other remains commingled, although Trachodonts usually predominate. Ceratopsian remains are rarely found massed without admixture of other forms. There is no record of an occurrence of two or more specimens of *Triceratops* having been found together in one place, but three *Monoclonius* quarries were observed by the writer in the Belly River strata of the Red Deer River and in one quarry no less than eleven individuals were determined from fragmentary skulls. In this particular quarry every bone exposed was that of *Monoclonius* or *Ceratops* and no other vertebrate fossils were represented. This purely circumstantial evidence of occurrence may or may not have value in considering their habits, but it would seem to indicate that the Belly River genera were gregarious.

The first discovery of any fossil referable to the Ceratopsia must be credited to Dr. F. V. Hayden who in 1855 collected in the Judith River badlands of Montana a single tooth which was figured in 1856 by Dr. Leidy.

In 1907 Hatcher, Marsh and Lull published a Monograph on the Ceratopsia in which most of the anatomy of the group is described, but in all of the vast amount of material preserved in different museums there was at that time no complete skeleton of a single individual, and the structure of the feet and length of tail have up to the present time remained problematical.

OCCURRENCE AND PREPARATION OF SKELETON.

The American Museum Expedition to the Red Deer River in 1914 was fortunate in finding a perfect skeleton of *Monoclonius,* No. 5351, complete in all details from the tip of the tail to the end of the nose with most of the bones articulated in position. It was lying on its left side with the phalanges exposed and some of the bones were damaged but parts of all were present. Part of the skeleton was surrounded by sandstone and ironstone matrix of such nature that much of the scientific value of the skeleton would have been sacrificed by extracting it for a free mount. Consequently the skeleton has been worked out in relief and mounted as a panel. The credit for the difficult preparation and mounting is due to the skilful work of Mr. P. C. Kaisen and Mr. Charles Lang.

The vertebral column, femora, right hind leg and left scapula and coracoid were left in the original matrix and mounted exactly as found. During fossilization the tibia, fibula and foot of the right hind leg have been rotated 45 degrees from normal so that the fibula appears back of the tibia instead of on the outside as it would appear in life. This foot was in position. Other front and hind foot bones are assembled after another perfectly articulated specimen, No. 5372, found in 1915, and are presented so as to show the front view of the right front foot and the palmar view of the left front foot. The right ilium was disarticulated and crushed vertically so that it does not exactly fit the other pelvic bones or the sacrum except along the transverse processes.

Most of the other bones of the skeleton are more or less compressed laterally, especially the limb bones and the transverse processes of the dorsal vertebræ which have been elevated considerably. The ribs have been flattened excepting the last five dorsals which retain their normal curvature.

In the description of a complete skull of *Monoclonius flexus*, Bull. Amer. Mus. Nat. Hist., Vol. XXXIII, Art. xxxiv, pp. 449–558, 1914, I expressed the opinion that *M. sphenoceros* was a synonym of *M. crassus*, a view that I continue to hold, but in the light of material recently collected it seems advisable to await more complete material from the type locality of the Judith River species before referring doubtful Belly River Ceratopsians to Judith River species. I shall therefore describe this complete skeleton as a new species.

Monoclonius *Cope.*

Characters assigned to the skeleton include those of family value.

Generic characters: Skull small to medium sized with three horns; nasal horn large, curved or straight, rising from middle of nasals immediately above the posterior border of the nares; supraorbital horns small or incipient. Nasals large; nares nearly separated by osseous septum formed by premaxillaries and nasals. Premaxillaries deep with vertical plate forming septum non-fenestrated. Crest composed of short, broad squamosals and extension of elongate coössified postfrontals or derm-supraoccipitals (parietals) perforated by large fenestræ; each fenestra wholly within the boundary of the derm-supraoccipitals. Margin of crest crenulated, each prominence bearing a separate ossification. A pair of long curved hook-like processes on posterior border of derm-supraoccipitals, orbit round, eye with sclerotic bony plates.

Vertebral column composed of 77 vertebræ comprising 21 presacrals, 10 sacrals and 46 caudals. The three anterior cervicals coössified.

Pelvis: Ilium, long and narrow. Ischium long and moderately curved. Pubis with long thin postpubis.

Scapula long, narrow and straight.

Coracoid with pronounced curved distal point.

Humerus long and only moderately robust with deltoid crest terminating above the middle of the shaft.

Carpus with 2 ossified carpals.

Manus with five digits, the inner three bearing hoofs; phalangeal formula, I = 2, II = 3, III = 4, IV = 3, V = 2.

Femur with vestigial fourth trochanter, in middle of shaft.

Tibia and *fibula* more than half the length of femur.

Tarsus with 4 ossified tarsals in two rows.

Pes with four functional digits bearing hoofs and the fifth vestigial, represented by reduced metatarsal. Phalangeal formula, I = 2, II = 3, III = 4, IV = 5.

Monoclonius nasicornus sp. nov.

Type of species: A complete skeleton, No. 5351.

Horizon and locality: Belly River formation, 100 feet below top of beds, north fork of Sand Creek, 12 miles below Steveville, Red Deer River, Alberta, Canada.

Specific characters: Skull with short face; supraorbital horns incipient, nasal horn long, straight and laterally compressed; epoccipitals large. Two inwardly directed processes on posterior end of frill; a forwardly directed process over each fontanelle. Teeth with low median carina and not more than 31 vertical rows.

For advantage of comparison the different parts of the skeleton will be treated in the order described in the Monograph of the Ceratopsia by Hatcher, Marsh and Lull.

Skull.

Most writers in describing species of the Ceratopsia have attached greater importance to the development of the horns and accessory frill growths than to me seems warranted. These parts are subject to great individual variation and too much stress should not be laid on such characters when they are not corroborated by differences of the fundamental skull elements.

Compared with the type skull of *Monoclonius flexus* this new species shows a striking difference in the development of the facial region as may be seen from the measurements given below.

The skulls are of equal width and height and *M. nasicornus* is 17^c shorter than *M. flexus*, but the shortness is accentuated by the contraction of the facial portion in front of the orbits; minor differences are observed in the frill.

The nasal horn is long, straight, massive and laterally compressed but less compressed than in *M. crassus* (*sphenoceros*) which it resembles. In *M. flexus* the nasal horn curves forward and is ovate in cross-section. Rugosities appear above the eyes but the orbital horns are incipient and less developed than in *M. flexus*. The skull character of greatest importance in distinguishing this species is the short face in which nasals and premaxillaries are both much shorter than in *M. flexus*. The superior border of the premaxillaries where they unite with the nasals are angular, swollen and rugose.

The frill or crest is in areal dimension nearly equal to that of *M. flexus* with the central derm-supraoccipital portion somewhat modified. This central element consists of a median thin, roof-like, posteriorly directed bar which at the end divides forming a T, and the cross-bar continues outward and forward in a broad curve to unite with the squamosal and the central portion at its origin, thus enclosing on each side a large fontanelle as in all monoclonid Ceratopsia. At the extreme posterior end the cross-bar of the T is broadly incised and flanked on each side by a large hook-like process. These hooked processes approach each other one-half nearer than in *M. flexus*.

Opposite the hooked process on the anterior face there is a large free spur that extends forward over each fontanelle. On the free borders of the frill there are large epoccipital bones that increase in size from below upward, all considerably larger than in *M. flexus;* five are present on the squamosal and four on each side of the derm-supraoccipital.

The squamosal is exactly like that of *M. flexus* and the laterotemporal vacuities are relatively smaller than in *M. flexus*.

In this specimen five plates of the sclerotic ring are preserved in the right orbit, the first recorded occurrence in this family. The plates differ from those of Trachodonts, and I believe the sclerotic ring was not capable of as much expansion and contraction as in forms where the eye occupied relatively less of the orbital space. The outer surface of each plate is finely rugose and one-half was overlapped by the succeeding plate; the upper and lower borders are both thin and irregular.

In the maxillary there are 29 rows of teeth having the same method of succession and implantation as in *Triceratops*. The teeth differ from those of *Triceratops* in the position of the median carina which instead of being central is invariably located on the posterior third of the enamel face.

The lower jaws are less massive than in *Triceratops* with a reduced number of teeth. The elements that compose the mandible are of the same form as in *Triceratops* but the surangular is relatively much larger.

In the right dentary there are 29 alveoli and in the left dentary 31. Not more than five teeth are determinable in any vertical row although there may be incipient teeth at the base not detected. In the middle rows the central carina of the enameled crown is relatively higher than in *Triceratops* and the outward curvature of the rows is consequently greater.

Skull measurements.

	M. nasicornus	*M. flexus*
Total length of skull measured over face	1420 mm.	1570 mm.
" " " " between posterior central border of derm-supraoccipital and rostral	1330 "	1410 "
Length between center of orbits and posterior border of nasal horn	177 "	230 "
Length between anterior border of nasal horn and rostral	250 "	355 "

VERTEBRAL COLUMN.

The complete vertebral column comprises 77 vertebræ distinguished as follows: 21 presacrals in which there are 9 cervicals and 12 dorsals; 10 sacrals; and 46 caudals. The form of the vertebræ is the same as in *Triceratops* which has been adequately and accurately described in the Ceratopsia Monograph. It is only necessary here to point out features that define this species and settle doubtful points in previous descriptions of the family. There are no true lumbars and I have considered as sacrals all of those vertebræ that are coössified by their centra. All of these support the ilia, including the anterior sacral which carries an independent short rib underlying the ilium. In the description of the vertebral column in the Monograph Hatcher and Lull (p. 47) have considered the division between cervicals and dorsals to be governed chiefly by the length and curvature of the ribs. This I take exception to, not only from the form of the ribs but also the position of the capitular facets and the entire form of the ninth vertebra. In the cervical series throughout the Dinosauria the capitular facets are invariably located on the centra of the vertebræ, the change from the cervical to the dorsal series being marked by the rise of this facet from the centrum to the neural arch. In *Monoclonius* the last vertebra having a capitular facet on the centrum is the ninth. The spine of this vertebra is narrow anteroposteriorly like that of the preceding cervicals, with the transverse processes small. The head of the rib for this vertebra is distinctly divided into a tubercular and capitular portion with exactly the same form as the two preceding cervical ribs. In this skeleton the rib of the ninth vertebra is as long as the next succeeding rib but it is much straighter in the shaft and narrower like the two preceding definitely determined cervicals.

Cervical Series.

The three anterior cervicals are coössified as in all known genera of the Ceratopsia. Besides this specimen there are in the American Museum collection three other *Monoclonius* coössified cervicals which show distinctly that there are only three vertebræ represented in this coössified section. Moreover there is one coössified section of a *Triceratops* in the collection. All of these specimens show only three vertebral divisions clearly marked by the point of union of the vertebræ, the neural arches and spines. Lull was evidently mistaken in determining four vertebræ in this section as described and figured in the Monograph (p. 47).

The atlas is deeply cupped anteriorly, the same length as the succeeding vertebra and the spine is separated from the succeeding spine at its base by a round foramen. The top of the spine is coössified with the next succeeding spine. The second or axis vertebra carries the first rib of the cervical series. The centra of the second and third vertebræ are coössified but the spines and zygapophyses are distinct. Succeeding vertebræ in the cervical series are as described in the Monograph. There is apparently a gradual decrease in the length of the centra up to the eighth which is shortest. The ninth vertebra is as long as the first dorsal but the centrum is not so high nor is it excavated on the sides as much as in the dorsal series.

Dorsal Series.

According to the above determination there are 12 dorsal vertebræ in the series. The sides of the centre are quite deeply excavated, spines broad anteroposteriorly and high, and transverse processes oblique to the spines. In this specimen the transverse processes are unquestionably elevated considerably more than normal so that the obliquity to the spines is increased.

Sacral Series.

As in all known genera of the Ceratopsia there are 10 sacrals, all coössified by their centra and united with the ilia by the transverse processes. So far as can be determined from this specimen and *Monoclonius cutleri*, No. 5427, described at the end of this paper, the sacrum follows the same general form and development as that described in *Triceratops*. The spines of the sacral vertebræ are short, broad anteroposteriorly and apparently those from the second to the seventh are coössified.

Caudal Series.

The caudal series is complete and is composed of 46 vertebræ including the minute terminal centrum. 23 of the anterior caudals bear transverse processes. The centra and spines of the caudal series decrease in size uniformly from the last sacral vertebra down to the 45th. The 46th apparently does not have a spine. The centra of the last 12 caudals are proportionately longer than high, slightly cupped on the anterior end with a corresponding ball on the posterior end and the spines of these last 12 vertebræ are likewise elongated anteroposteriorly. The spines in the caudal series are in height equal to the length of the corresponding chevrons and they are not as high as in the genus *Leptoceratops*.

From the development of the caudal series as a whole, the absence of a well developed 4th trochanter on the femur, and a forwardly curved ischium, it seems probable that the tail did not function as a balancing organ nor could it have been used to any extent in swimming. That portion of it back of the 34th caudal dragged on the ground.

Chevrons.

There are 32 chevrons, which is apparently the complete series, the first being between the 3rd and 4th vertebra. They increase in length from the 1st to the 4th and then gradually decrease from the 7th back to the 32nd. From the 21st back to the 32nd the lower end is expanded anteroposteriorly. Beyond the 32nd there are apparently no facets for chevrons.

Ossified Tendons.

In this specimen there is a mass of ossified tendons grouped upon the sacrum. Over the center of the sacrum they are fused apparently without any regular order or placement and the free ends extend posteriorly to the spine of the 9th sacral vertebra and anteriorly to the 6th dorsal. The tendon rods, where separated, are round and the distal ends are expanded and fimbricated. They do not appear to have been in regular rows as found in different genera of the Trachodontidæ.

Pelvis.

All three elements of the pelvis enter into the construction of the acetabulum as in *Triceratops*. In this specimen the ilium on the right side was detached, fossilized independently and so crushed in the vertical plane that it could not be accurately articulated with the sacrum or other pelvic bones. It is here placed in articulation with the transverse processes of the sacrum. Owing to vertical crushing, the anterior blade of the ilium, which should be straight, as will be seen by a comparison with the accompanying illustration of the pelvis in *Monoclonius cutleri*, No. 5427, is decurved.

Ilium.

The ilium is markedly different from *Triceratops* in that it is elongated to a greater extent and is not so wide. That part of it posterior to the ischiadic peduncle is like that of *Triceratops*.

Pubis.

The pubis is like that of *Triceratops* in form with, however, a longer post-pubis and the entire bone is less massive.

Ischium.

The ischium is proportionately longer than in *Triceratops* and the distal end is curved forward less, whereas in *Monoclonius crassus* the blade is very long, straight throughout most of its length and sharply decurved at the distal end.

SHOULDER-GIRDLE.

The pectoral arch includes the scapulæ, coracoids and two flat sternal plates. In this specimen the left coracoid and scapula have been retained in the position in which they were found. It is possible that the scapulæ and coracoids have dropped slightly lower than their normal position, but they have retained their proper relative horizontal position thus defining the chest.

Scapula.

The scapula apparently has the same general form as in *Triceratops* but with a deeper glenoid cavity. The blade is long, thin and moderately expanded at the distal end but less than in *Monoclonius crassus*. On the outer face a high ridge extends from the border of the glenoid cavity diagonally across the blade to the distal end.

Coracoid.

The coracoid is united by suture with the scapula and shares equally with it in the formation of the glenoid cavity. The outer face is distinctly convex and it terminates in a long pointed process for articulation with the sternum. The coracoid foramen is large and passes diagonally through the coracoid as in *Triceratops*, the internal opening situated close to the coraco-scapular union.

Sternum.

Previous to the publication of the Monograph on the Ceratopsia (1907) I described the sternum of *Triceratops* in an article entitled "New Notes on the Osteology of *Triceratops*," Bull. Amer. Mus. Nat. Hist., Vol. XXII, Art.

xvii, pp. 297–300, 1906, a paper that evidently escaped the notice of the authors of the Ceratopsia Monograph. The sternum of *Monoclonius* differs from that of *Triceratops* only in size. It consists of two broad flat plates, each plate having a thick external border and a thin internal border for articulation with its mate. The anterior end is thickened on the external border for articulation with the process of the coracoid, while the distal end is thick and shows on the ventral surface indentures for the attachment of the cartilaginous ribs. The dorsal surface of each plate is flat and the ventral surface is marked by a low ridge that extends from the proximal to the distal end near the outer border. There was probably no intermediate cartilaginous element.

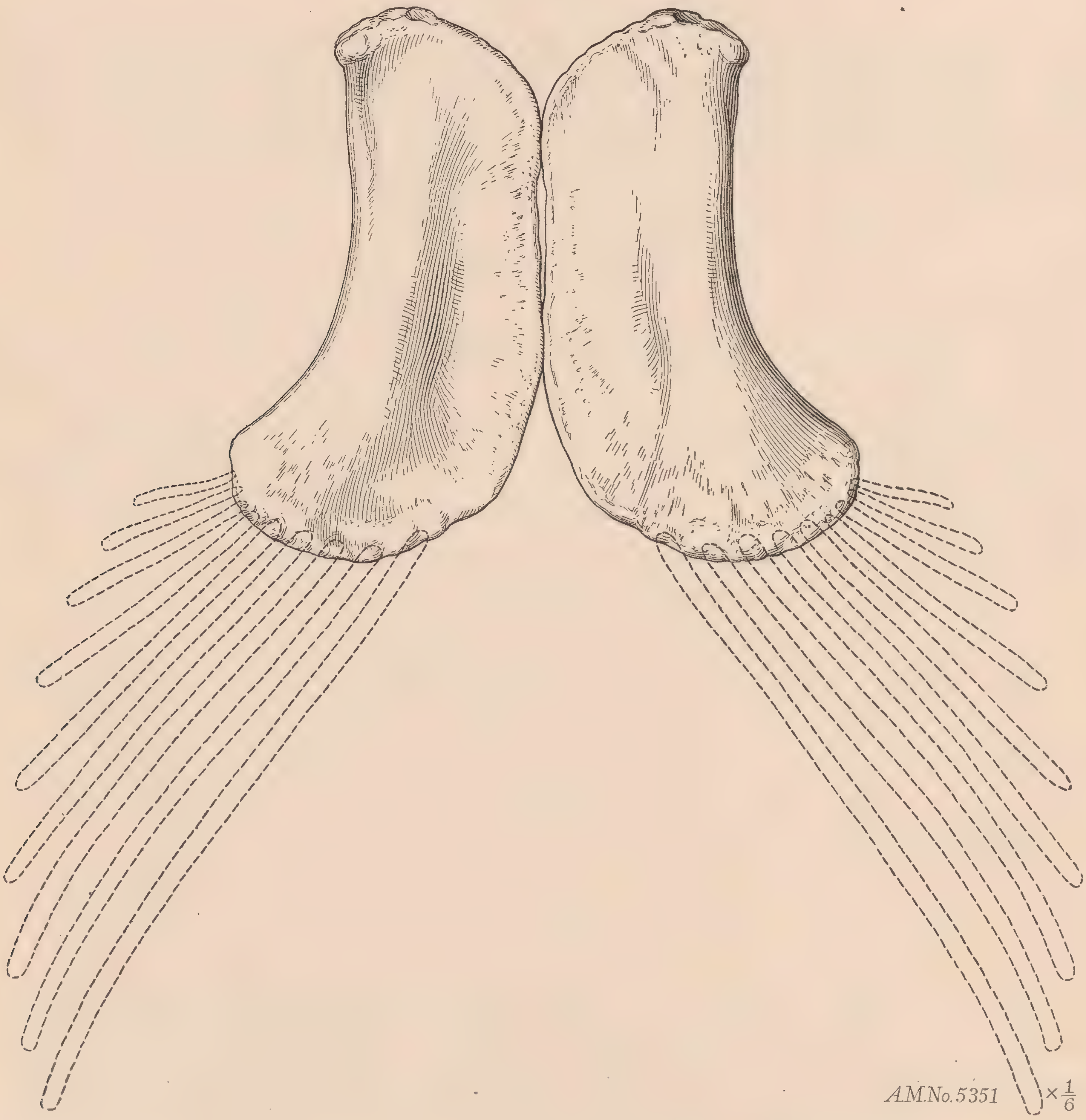


Fig. 3. Ventral view of sternal plates showing cartilaginous attachments.

RIBS.

In the cervical-dorsal-sacral series there are 21 ribs, beginning with the 2nd cervical and ending with the 1st sacral. The cervical ribs show a great variety in form. The 1st cervical is comparatively slender; the 2nd cervical is quite broad at the union of the capitular and tubercular heads with the shaft, and there is a central anteriorly-directed sharp process. The center of the rib is broad and the distal third of its length is thin and pointed. This construction follows in the next succeeding or 3rd rib and the 4th is about the same length but its central part is the broadest in the cervical

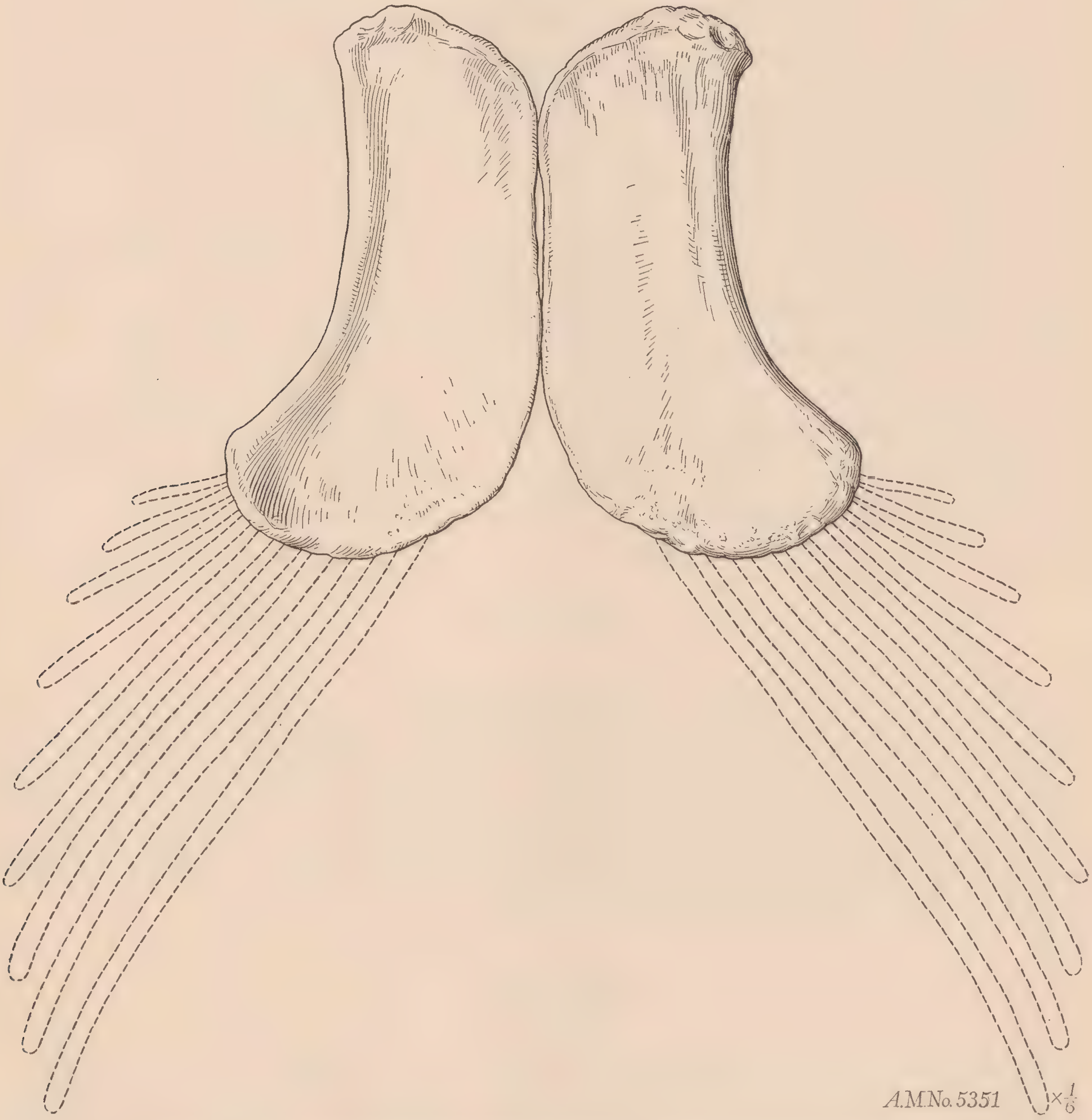


Fig. 4. Dorsal view of sternal plates showing cartilaginous attachments.

series. The 5th rib is not so broad as the 4th but distally it is round and lengthened, taking on the character of the succeeding long cervicals. The 6th, 7th and 8th cervical ribs lie within the confines of the pectoral arch and increase in length rapidly, the 8th rib being almost as long as the succeeding 1st dorsal. The 9th rib, the 1st dorsal, is expanded distally for connection with the 1st abdominal cartilaginous rib. The 3rd dorsal rib is apparently the longest in the series, although there is little difference in length among the 2nd, 3rd, 4th, 5th and 6th dorsals. All of the dorsal ribs in this specimen excepting the last four are considerably flattened and on account of lateral crushing have not been articulated with the transverse processes of the vertebræ. The last four are less robust than the preceding ribs and they have retained their normal curvature.

As may be seen by comparison with this skeleton and the restorations of *Triceratops* by Marsh, Hatcher and Lull, the last four dorsal ribs are much longer than are represented in *Triceratops*. Normally in position the last dorsal rib is curved forward, outward and inward at its distal end, just in front of the anterior end of the ilium. This gives a much greater girth to the body in this region than in previous restorations. The independent sacral rib is slender, comparatively short, extending forward and outward and underlies the normal ilium.

Fore Limb.

Compared with *Triceratops* the general form of the fore limb is the same but it is less massive throughout; the humerus is relatively longer and the ulna and radius are relatively shorter. When the limb is articulated in relation to the skeleton the elbow bends outward to a marked degree, the digits facing outward rather than forward, the axis of digit II being approximately parallel with the line of the vertebral column.

Humerus.

The humerus is broadly expanded transversely at the upper end with the radial crest terminating near the middle of the bone. The shaft is round and the distal end is not greatly expanded. Ulnar and radial condyles are about equal in size.

Ulna.

The ulna is distinguished from that of *Triceratops* chiefly by its size but in comparison with the humerus it is shorter. The same muscular rugosities are present.

Radius.

Except in size the radius does not differ from that of *Triceratops;* the shaft is long and slender and the ends are expanded, the distal end slightly oblique to the shaft.

Manus.

The entire manus denotes a foot of less digital movement than in carnivorous dinosaurs or the active Trachodonts. The rugose furrowed ends of the metacarpals and metatarsals indicate considerable cartilage in the joints of both manus and pes.

Five digits are present having the formula $\mathrm{I}^{=2}$, $\mathrm{II}^{=3}$, $\mathrm{III}^{=4}$, $\mathrm{IV}^{=3}$, $\mathrm{V}^{=2}$. All known bones of the manus in *Triceratops* agree perfectly in form with this specimen and the construction was doubtless the same in both genera, probably throughout the family.

The manus was considerably arched and the metacarpals articulated with each other closer than they are placed in this specimen in which the proximal ends are crushed. The three inner digits terminating in hoofs contributed chiefly in support of the weight.

Carpals.

Two ossified carpals are present, both irregular, flattened and deeply pitted. One is twice the size of the other and they are here placed as in the perfectly articulated foot of another specimen, No. 5372, the larger carpal on the ulnar side. The rest of the series were doubtless cartilaginous.

Metacarpals.

In all the metacarpals the shafts are constricted and the ends are expanded and deeply furrowed. The proximal ends vary in form, the first three being roughly triangular and more closely associated. The distal ends of all are expanded transversely. Metacarpal I is the shortest and broadest of the series with the distal end slightly oblique and the proximal end excavated in the center. Metacarpal III is longest. Metacarpals IV and V show less intimate contact at the proximal ends and the distal ends are markedly reduced. Metacarpal V is slightly longer than metacarpal I and the distal end is rounded.

Phalanges.

Digits I, II, and III terminated in hoofs and IV and V in reduced rounded phalanges that were not ensheathed. There was little lateral movement possible between the phalanges.

The phalanges of the manus are distinguished from those of the pes by their less vertical depth, expanded, flattened distal ends, and rugose surfaces. The proximal phalanx of digit I is the largest and heaviest of the series. The terminal phalanx of this digit is also the largest ungual and it is considerably longer in the neck than the other unguals. In digit II the second phalanx is about two-thirds the size of the first and the ungual is broad and shorter than the ungual of digit I. In digit III the ungual is much smaller than in digit II. The phalanges of digit IV are flat and broad and the terminal phalanx is greatly reduced in size without indication of a hoof having been present. In digit V only two phalanges are present, the proximal one broad and flat with the distal end oblique and its articular face carried far up on the outer border. The terminal phalanx is a rounded nodular bone.

HIND LIMB.

In general form the hind limb and foot are like those of *Triceratops*, showing the same development and muscular attachments. But in this species and in *Monoclonius crassus* the tibia is relatively longer. The size of the hind limb compared to the front limb is the same as in *Triceratops*.

Femur.

Taking into consideration the size and the amount of distortion due to crushing there is no marked difference from the femur of *Triceratops*.

The shaft is long and straight with a slight inward curvature at the distal end. The head is elevated only slightly above the great trochanter although on the right side in this specimen it is crushed considerably above the normal position.

The fourth trochanter is not extensive and terminates a little below the middle of the shaft. The condyles are crushed laterally but appear to be relatively the same as in *Triceratops*.

Tibia.

As pointed out above the tibia is relatively longer than in *Triceratops*. In this specimen the femur is only 140 mm. longer than the tibia, whereas in *Triceratops prorsus* the femur is a half again larger than the tibia. In *Monoclonius crassus* the relative size of femur and tibia is similar to the present species but in *Monoclonius cutleri* described and figured at the close of this article the comparative size of femur and tibia is the same as in *Triceratops prorsus.* I believe that the relative lengths of limb bones is at least of specific value in this family.

Both tibiæ are badly crushed in this specimen and I can see no marked departure in form from the typical *Triceratops.*

Fibula.

The fibula is long and slender with subcylindrical shaft and expanded ends. It is relatively as large as in *Triceratops.* With the calcaneum it equals the length of the tibia. At the distal end the surface applied to the tibia is flat and the outer face is convex with the terminal end swollen. The upper end is warped on the shaft so that the greatest diameter of the proximal end is at right angles to the distal end.

PES.

In the pes there are two rows of ossified tarsals, four functional digits and a rudimentary fifth digit. This is probably the normal type of foot throughout the family. It is the exact structure of *Triceratops* and they differ only in size as determined from a complete foot in the American Museum collection found since the publication of the Ceratopsia Monograph.

The pes of *Triceratops* was supposed by Marsh to have but three complete digits. It is so considered in the "Ceratopsia" Monograph and so restored in the mounted skeleton in the U. S. National Museum. There is no doubt, however, that it was tetradactyl and proportioned like that of *Monoclonius.*

The foot displays considerable arch and there was but little lateral movement between the segments. The second and third digits faced forward and the axis of the foot appears to have been between them. The articular faces of the phalanges on the third digit are oblique, so that they curve forward with the terminal hoof only a little posterior to the terminal of the second digit. The first digit was short and powerful and directed well to the inside.

The articular faces of the phalanges are squarely on the ends and only slightly reflexed indicating a vertical position in life that recalls the heavy, fleshy foot of the Proboscidea.

Tarsals.

The astragalus, the largest element in the tarsus, was firmly united to the tibia with which it was to a high degree coössified. The coössification of tibia and astragalus was doubtless a family character for in every specimen known to the writer, representing several genera, the tibia and astragalus are inseparable. In the Trachodontidæ the tibia and astragalus were firmly united but not coössified.

The astragalus is a moderately thick, flattened plate covering about three-fourths of the end of the tibia, its posterior border thin and its anterior border thick but not extending far up on the face of the tibia. The borders are deeply pitted.

The calcaneum is about one-third as large as the astragalus and it was free. In the second row of tarsals two ossified elements are preserved, the largest articulated with the 4th metatarsal.

Metatarsals.

The functional metatarsals are much larger than the metacarpals and more closely applied throughout most of their length. Metatarsals II, III and IV are especially interesting as they are similar in form and development to these elements in the Trachodontidæ. Metatarsal I is short and heavy, its proximal end triangular and slightly cupped; the shaft is closely applied to the shaft of metatarsal II for four-fifths of its length where it abruptly bends away and the distal end is reflexed, permitting more lateral movement than was possible in the other digits. Metatarsal II is a little longer than metatarsal IV; the proximal end is quadrilateral in form, its greatest length antero-posterior; the shaft is straight and the distal end is expanded laterally. Metatarsal III is longest of the series; its proximal end is roughly triangular in form with the outer border thin and interlocking with the head of metatarsal IV; the shaft is straight on the inner face and curved on the outer face, the distal end broadly expanded laterally. Metatarsal IV is broadly expanded laterally at its proximal end, triangular in form and deeply cupped; on the inner face there is a deep incision receiving a part of the head of metatarsal III; the shaft is straight on the inner face and strongly curved on the outer face. Metatarsal V is a mere vestige without phalanges and but loosely applied to metatarsal IV; it is about two-thirds the length of metatarsal I; the proximal end is comparatively large and ovate and the shaft is laterally compressed, the anteroposterior diameter being three to four times greater than the lateral diameter in any given section; the distal end is small and rounded.

Phalanges.

The phalanges, excepting the unguals, are readily distinguished from those of Trachodonts by the abrupt vertical sides and deep lateral depression near the distal end for the insertion of digital muscles. A slight difference is noticeable in the two sides. The outer faces of the phalanges in digits I, II and III are slightly more vertical than the inner faces. In digit IV this distinction is reversed.

The proximal phalanx of digit I is the longest and largest of the phalanges and nearly as long as metatarsal I. Its proximal end is oblique and the shaft is comparatively flattened. The ungual of digit I is slightly longer than that of digit II, is narrower and tapers to a point.

In digit II the first phalanx is half as long again as the second and the third is largest of all the unguals.

In digit III the phalanges grade rather uniformly and the ungual is somewhat narrower than in digit II.

In digit IV the phalanges grade abruptly; the entire series is shorter than in digit III, and the terminal is smallest of the unguals. As remarked before the articular faces are oblique and the inner face of each phalanx is shorter than the outer face; thus the entire toe curves forward.

Exoskeleton and Epidermis.

There is no evidence of an exoskeleton in this specimen. It is now known that the epidermis over the belly and sides was a free tuberculated skin comparable to the epidermis of the Trachodontidæ but of different pattern with low, polygonal, non-imbricating tubercles. With another specimen, No. 5430, probably this genus, seven dermal plates were preserved, all similar in form, symmetrical and about equal in size. Each is characterized by a narrow, elongate base and a high, median center. They are about an inch wide, an inch and a half long and an inch and a half high. In that specimen the pelvis, a part of the tail, and the hind limbs are preserved and the plates were probably located above the spines in the caudal region similar to those of *Ceratosaurus*.

It may be stated definitely that none of the plates figured in the Ceratopsia Monograph, page 65, pertain to this family. Those figured 1–10 are from armored dinosaurs of ankylosaurid type. The specimen figured 11–12 is probably not dinosaurian, the bone being very dense whereas dermal bones are highly cancellous. It is probably fish.

Reconstruction.

This reconstruction (Plate XIII) differs in several important features from the Marsh reconstruction of *Triceratops* and from the composite *Triceratops* skeleton mounted in the National Museum.

The body is shorter and deeper in the posterior dorsal region, while the feet are more digitigrade with toes turning out, the axis of the manus through digit II and the axis of the pes between digits II and III.

A *Triceratops* skeleton in the American Museum determines the general construction to have been essentially the same in the two genera and the skeletal structure in *Monoclonius* may be considered as typical of the family Ceratopsia.

Measurements of Monoclonius Skeleton. No. 5351.

Skull	mm.
Total length between rostral and terminal end of epoccipitals	1420
Length between condyles and anterior end of rostral	760
Length of nasals	400
Width between orbits	260
Greatest width of crest between borders of squamosals	1100
Height of skull between posterior end of nasals and border of alveolus	360
Extreme height of nasal horn from top of nasals, anteriorly	460
Circumference of nasal horn at base	400
Length of alveolus	300
Vertebral column	
Total length of vertebral column and skull from end of tail to rostral	5160
“ “ “ vertebral column from end of tail to condyle of skull	4460
Length of three anterior coössified cervicals	260
Total length of sacrum	800
“ “ “ ilium	1060
“ “ “ pubis excluding postpubis	450
“ “ “ ischium, following curve iliac peduncle to end	740
“ “ “ scapula	700
“ “ “ “ and coracoid	910
Width of distal end of scapula	220
Greatest width of proximal end of scapula	260
Length of sternum	330
Greatest width of sternum, posterior end	160
“ “ “ “ proximal “	110
Length of humerus	600
“ “ “ from end of deltoid crest to end of inner condyle	380
“ “ ulna	450
“ “ radius	350
Manus	
Length of metacarpal I	83
“ “ “ II	127

	mm.
Length of metacarpal III	130
“ “ “ IV	99
“ “ “ V	80
“ “ phalanx I^1	56
“ “ “ I^2	64
“ “ “ II^1	46
“ “ “ II^2	30
“ “ “ II^3	55
“ “ “ III^1	38
“ “ “ III^2	27
“ “ “ III^3	20
“ “ “ III^4	41
“ “ “ IV^1	34
“ “ “ IV^2	21
“ “ “ IV^3	18
“ “ “ V^1	43
“ “ “ V^2	13
Length of femur, outside measurement, from top of greater trochanter to bottom of condyle	740
Length of tibia including astragalus	600
“ “ fibula	560
Pes	
Length of metatarsal I	123
“ “ “ II	180
“ “ “ III	215
“ “ “ IV	160
“ “ “ V	77
“ “ phalanx I^1	101
“ “ “ I^2	97
“ “ “ II^1	69
“ “ “ II^2	46
“ “ “ II^3	93
“ “ “ III^1	60
“ “ “ III^2	37
“ “ “ III^3	35
“ “ “ III^4	80
“ “ “ IV^1	54
“ “ “ IV^2	35
“ “ “ IV^3	32
“ “ “ IV^4	23
“ “ “ IV^5	69

Monoclonius cutleri sp. nov.

This species is established on an incomplete skeleton (Plates XVI–XIX) found in the same region as the type of *Monoclonius nasicornus*, at about the same level but on another branch of North Sand Creek. It includes the posterior half of the skeleton, mostly connected, and a section of the epidermal impression overlying the right femur.

The entire skeleton had been present but the anterior half was too fragmentary to be preserved. The part of the skeleton preserved includes fragments of the skull, 8 posterior dorsal, 10 sacral and 31 caudal vertebræ, half of the ribs and chevrons, the sternal plates, half of the right scapula, 4 metacarpals and 3 phalanges of the right fore foot, and 3 phalanges of the left fore foot, the complete pelvis, femora, tibiæ, fibulæ, 4 metatarsals and 5 phalanges of the left hind foot, and 2 metatarsals and 1 phalanx of the right hind foot.

The reference to the genus *Monoclonius* is reasonably certain, the identification being based on fragments of the skull including the coössified anterior ends of nasals and premaxillaries which are diagnostic.

An element of doubt was the presence of the posterior end of a *Ceratops* derm-supraoccipital bone and a Trachodont tibia. But the skeleton was weathered out and the *Ceratops* bone was embedded in undisturbed strata one foot below bones of the skeleton, was water-worn and of different color, so that I feel safe in eliminating it from consideration.

Sufficient material is not yet available in this family to determine what species characters in the skeleton are constant nor are we able to correlate skull characters with those of the skeleton in many instances.

The relative length of limb bones appears to be constant in *Triceratops prorsus* and is definitely known to be constant in several genera of the Trachodontidæ.

In the specimen here described there are several characters, especially the length of the hind limb and the straight ischium, that distinguish it from *Monoclonius nasicornus*. These features are pronounced in different parts of the body and so obviously not a result of crushing that it seems advisable to refer it to a distinct species.

Type of species: An incomplete skeleton, No. 5427.

Horizon and locality: Belly River formation, 100 feet below top of beds, north fork of Sand Creek, 12 miles below Steveville, Red Deer River, Alberta, Canada.

Specific characters: Femur nearly half as long again as tibia; ischium very long and straight with distal end decurved; sternal plates elongate.

The animal was a little larger than the type specimen of *Monoclonius nasicornus* and the preserved bones, excepting those which distinguish this species, closely follow the form of similar parts in that species.

VERTEBRÆ.

The vertebræ are a little larger but of exactly the same form as in the type specimen of *Monoclonius nasicornus* and no distinctions are apparent in any part of the column. The sacrum is especially interesting as it shows a development exactly as in *Triceratops*. The third, fourth, fifth and sixth vertebræ bear diapophyses and parapophyses and may be considered the original true sacrals, additions having been made from the dorsal and caudal series. It is improbable that there were ever true lumbars in immediate ancestral forms for the first sacral vertebra carries a well developed, short, free rib underlying the point of the ilium.

STERNUM.

The sternal plates although displaced back of their normal position are still in approximately correct relation with each other and with the ribs on the right side.

They are markedly longer, narrower proximally and wider distally than in *Monoclonius nasicornus*.

RIBS.

Incomplete ribs are preserved on both sides, including the two posterior cervicals, twelve dorsals and the first sacral on the right side and two posterior dorsals and the first sacral on the left side. The last dorsal rib on each side is complete and uncrushed; they curve outward and forward then downward, outlining the body which follows the outward curve of the ilium and was much deeper in the flank than has been indicated in previous restorations of the horned dinosaurs. The free sacral rib is single-headed and flat, extending to the point of the ilium which it underlies.

PELVIS.

The ilia retain their normal position and are uncrushed but somewhat lengthened. Allowing for all cracks the anterior blade is much longer than in *Monoclonius crassus* or *Monoclonius nasicornus*. The ilium has the same general form as in *Triceratops* but the blade in front of the pubic peduncle is comparatively longer and narrower, a generic character.

The pubis has the same general form as in *Triceratops* but in this genus the post-pubis is relatively longer.

The ischium shows the most striking departure from the *Triceratops* pelvic bones and differs markedly from *Monoclonius nasicornus.* It resembles *Monoclonius crassus* and is long and comparatively straight with the posterior end sharply decurved and expanded, meeting its mate along this curved section.

HIND LIMB.

Compared with the type specimen of *M. nasicornus* and with *M. crassus;* the tibiæ and fibulæ are so much shorter that the difference in length cannot be attributed to individual variation. The femur is nearly once and a half as long again as the tibia, the same proportion as in *Triceratops prorsus.*

Femur.

The femora are flattened but the general form is well preserved, displaying a long, straight shaft with a large head that rises slightly above the level of the great trochanter. The lesser trochanter is separated from the great trochanter by a narrow cleft and terminates slightly below its summit. The fourth trochanter is a faint elevated ridge about six inches long that terminates a little below the middle of the shaft. The distal end of the femur curves inward from the line of the shaft and the inner condyle appears to be larger than the outer condyle, a condition which if true is the reverse of *Triceratops.* The crushed femora in the type specimen of *M. nasicornus* fails to settle this point.

Tibia.

The tibiæ are unequal in length, as is frequently the case in fossil bones, the left in this case being somewhat longer than the right. They are formed like *Triceratops* and are actually and relatively much shorter than in *M. nasicornus* or *M. crassus.*

Fibula.

The fibulæ are like those of *M. nasicornus* and of the same relative size.

Metapodials and Phalanges.

All of the preserved bones in both manus and pes appear to be the same as in *M. nasicornus,* the slight differences in form being attributable to crushing.

EPIDERMIS.

A section of the epidermal impression is preserved with this specimen which may be considered typical of the genus *Monoclonius.* It differs markedly in pattern from the integument described by Lambe in *Ceratops* (*Chasmosaurus* or *Protosaurus*), a related genus having an entirely different skull.

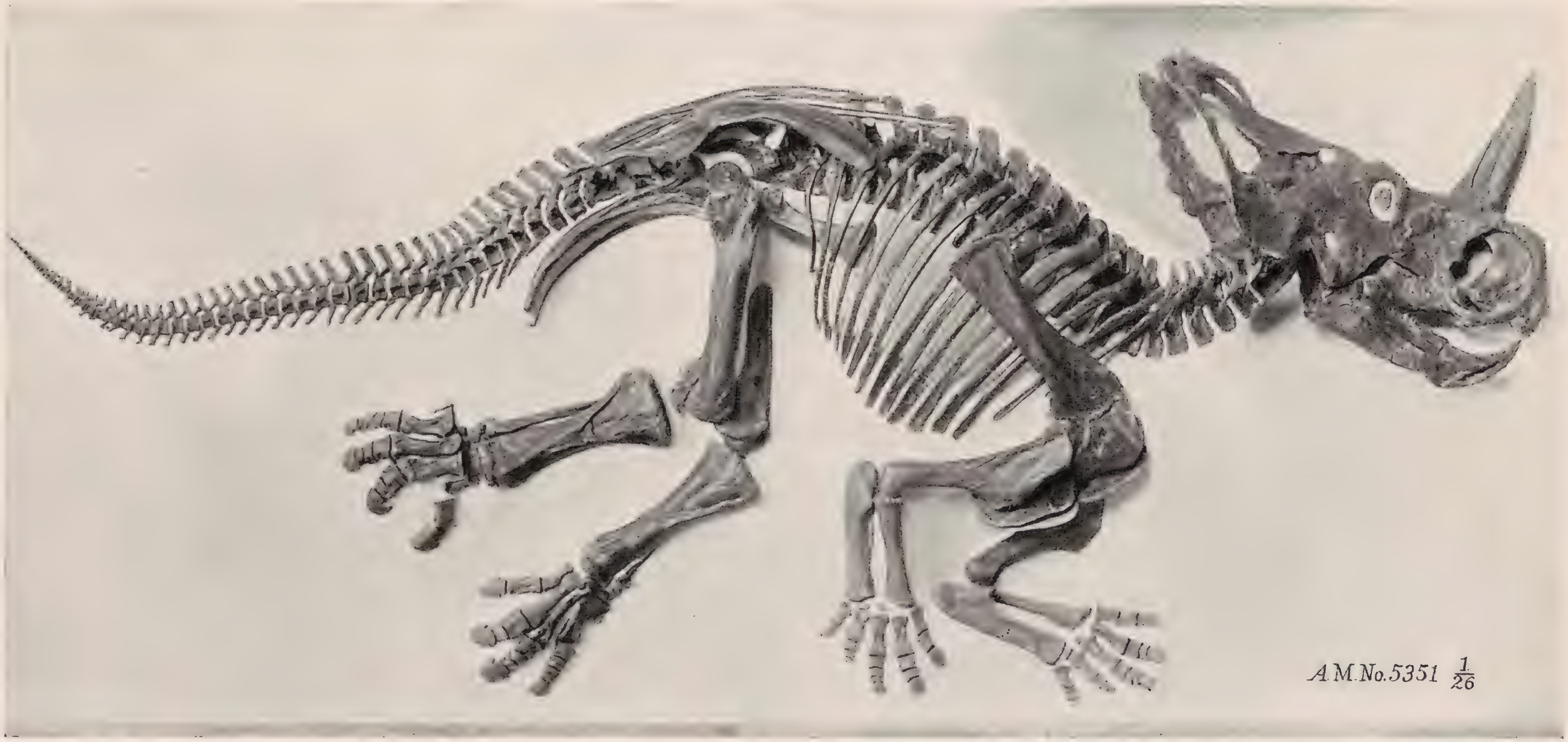
The epidermis overlies the lower end of the femur and in this section at least consists of small polygonal tubercles and large round tubercles, all low and of the same height.

The small tubercles are five or six-sided, close set together and do not grade in size up to the larger, round ones as they do in *Ceratops.* If attention is centered on any small tubercle five, six or seven adjacent ones are seen to touch its border. The large tubercles are defined by a circumscribing groove and are uniformly round; they were disposed in rows over a part, probably the ventral surface of the body.

Measurements.

	mm.
Total length of sacrum, bottom	800
“ “ “ ilium	1120
“ “ “ publis, excluding postpubis	500
“ “ “ ischium, iliac peduncle to end	800
“ “ “ sternum, left side	450
Greatest width of “ posterior end, left side	180
“ “ “ “ anterior “ “	110
Length of metacarpal I	97
“ “ “ II	140
“ “ “ III	143
“ “ “ IV	105
“ “ phalanx I^1	50
“ “ “ I^2	73
“ “ “ II^3	61
“ “ “ III^1	42
“ “ “ IV^1	36
“ “ femur, outside top of great trochanter to bottom of condyle	800
“ “ tibia, including astragalus	500

	mm.
Length of fibula	460
" " metatarsal I	103
" " " II	200
" " " III	230
" " " IV	184
" " " V	69
" " phalanx I^1	92
" " " II^1	64
" " " II^3	77
" " " III^1	40
" " " IV^4	77



MONOCLONIUS NASICORNUS.

Side view of skeleton of type, No. 5351, mounted in the American Museum. Bones for the most part articulated as found. The right ilium thrown upward out of position, ribs flattened and tubercular heads separated from transverse processes on vertebræ which are laterally compressed.

1916

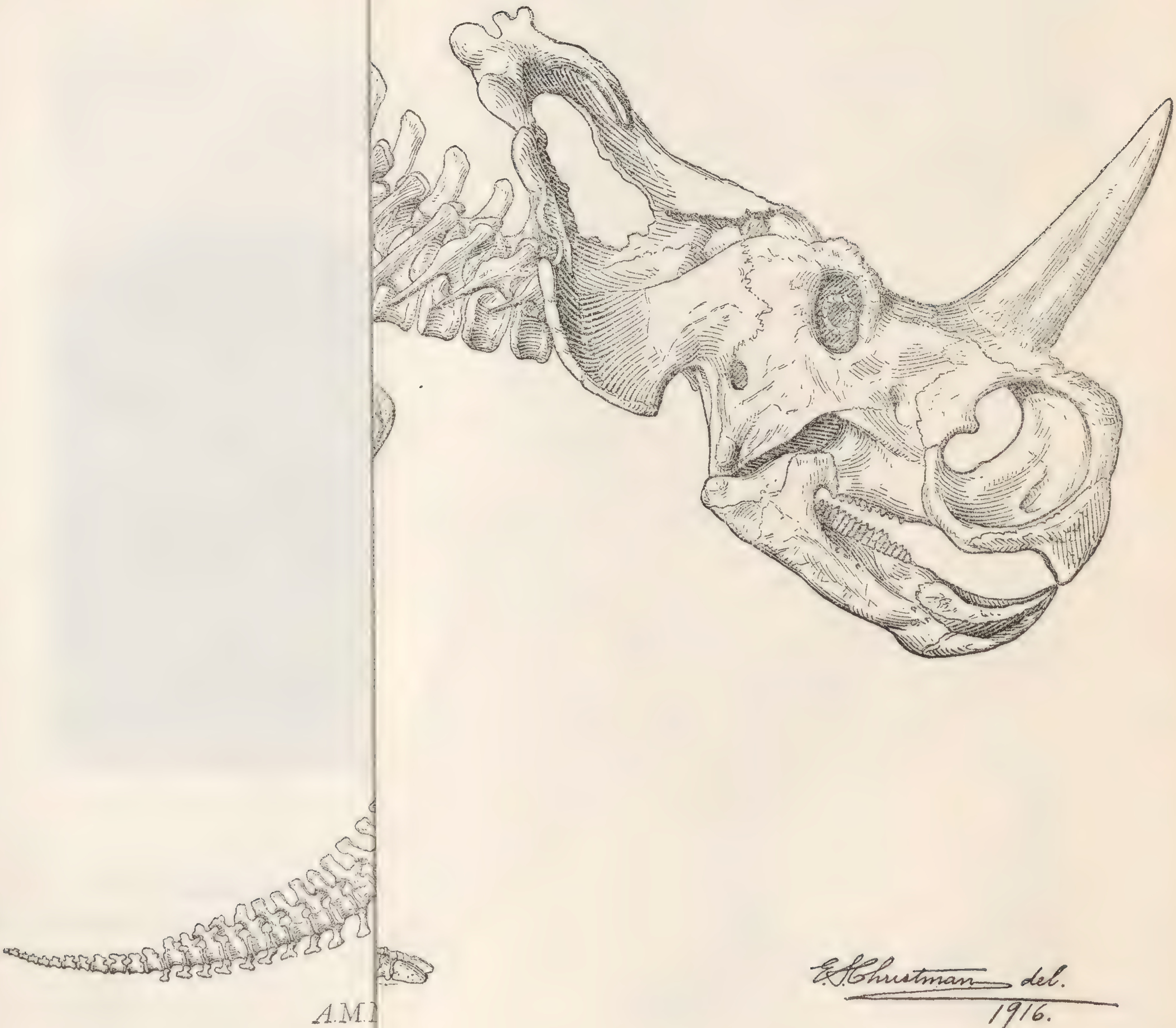
s.

ed by c

lonius s

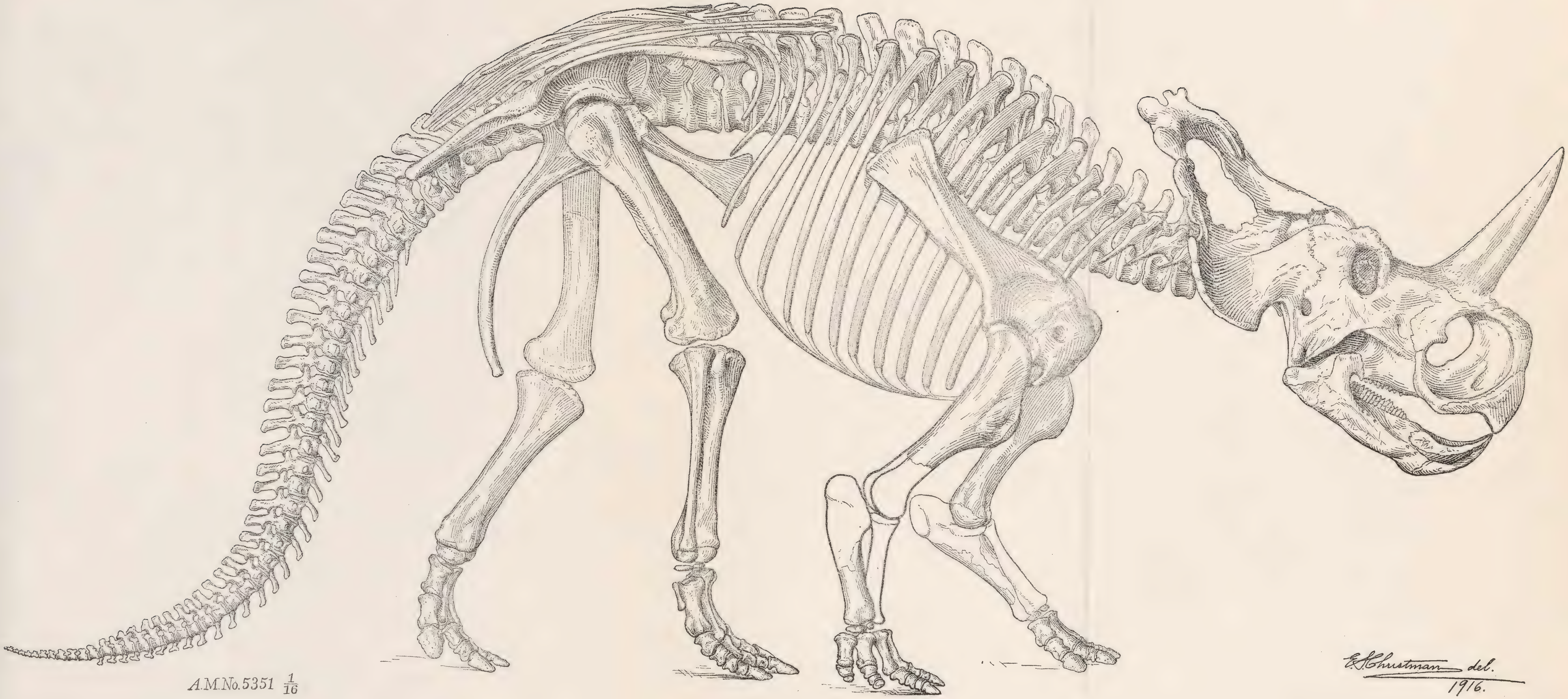
Monoclonius nasicornis.

Detailed view of axial skeleton of type, No. 5351. A, skull; B, cervical-dorsal series; C, pelvis, ilium decurved by crushing; D, caudal series; E, side view of right hind foot of *Monoclonius* sp., No. 5372; F, side view of right front foot of *Monoclonius* sp., No. 5372; G, dorsal view of front foot in detail, *Monoclonius* sp., No. 5372; H, dorsal view of hind foot in detail, No. 5372.

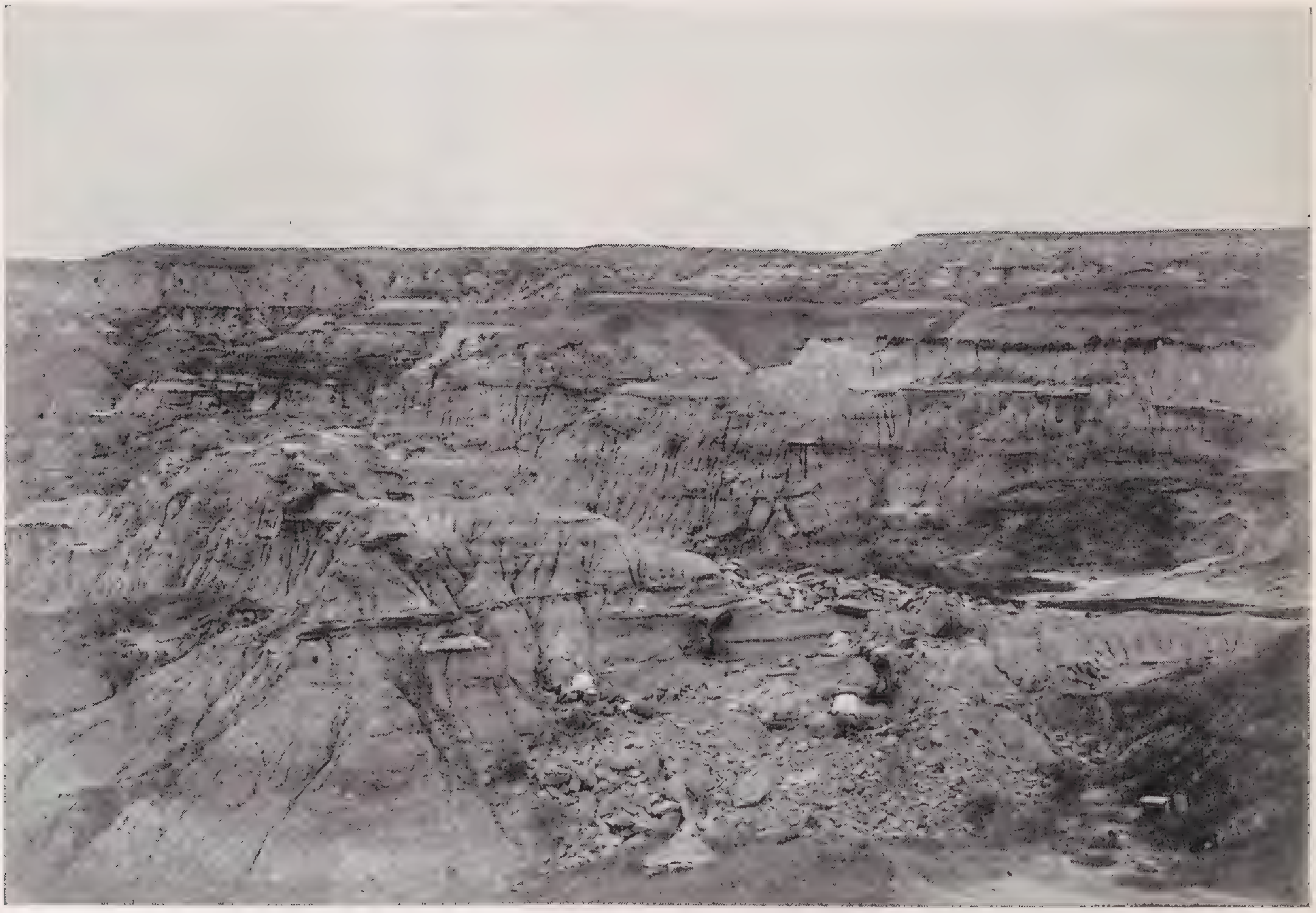


E. S. Christman del.
1916.

A.M

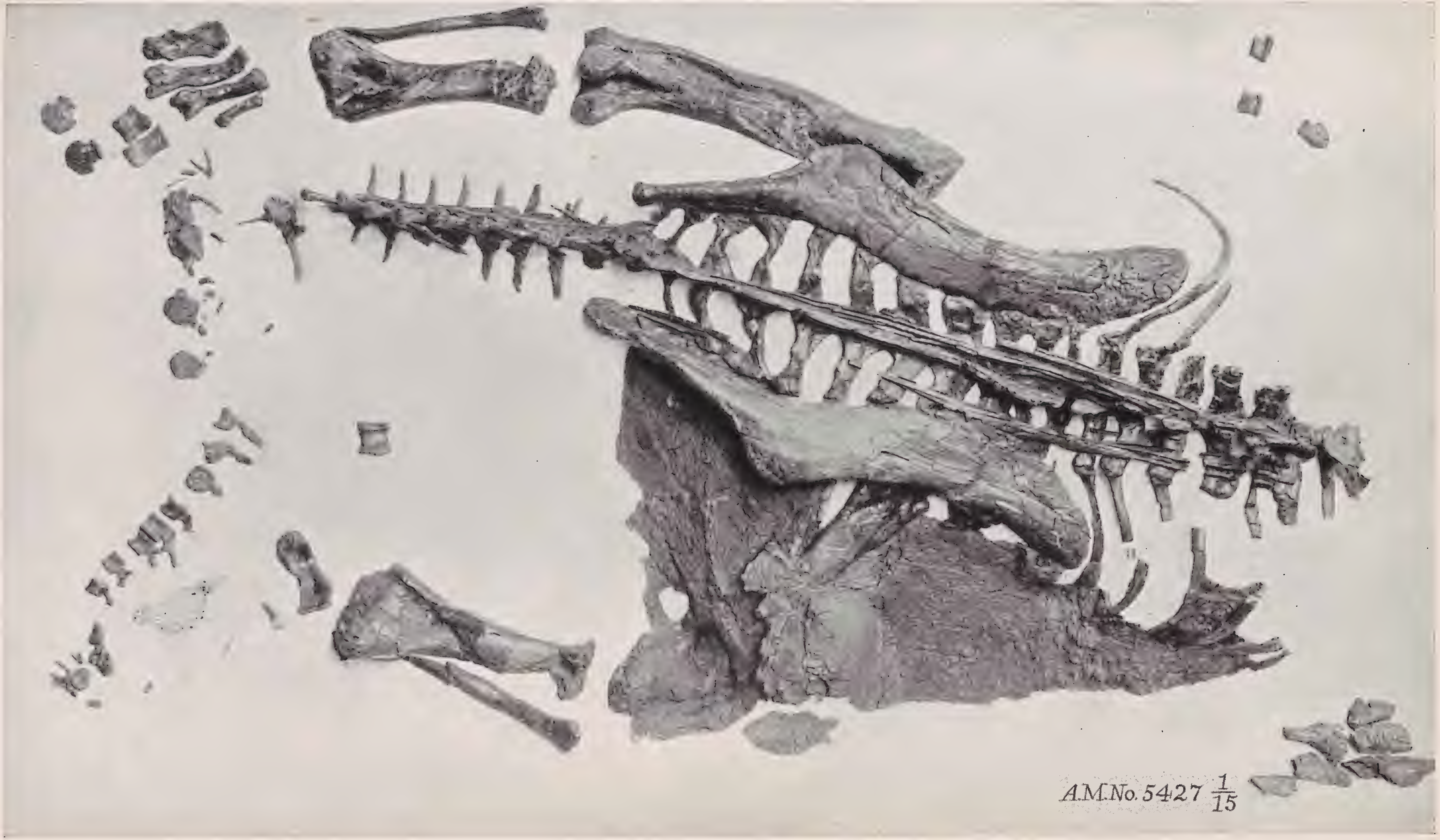


Monoclonius nasicornus.
Restoration of skeleton, No. 5351. Bones articulated as in life.



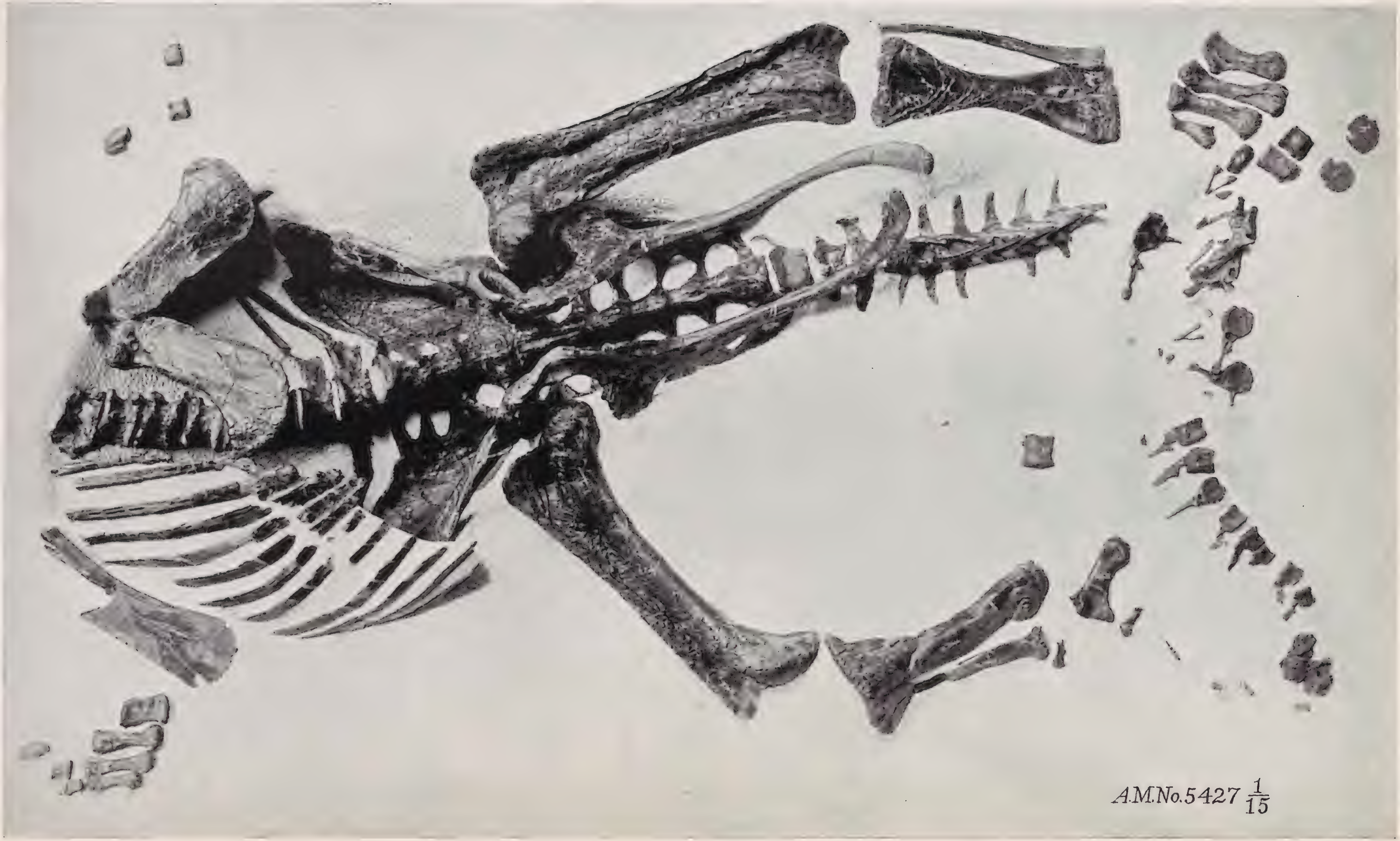
Monoclonius nasicornus.

Excavation of skeleton, No. 5351, north fork of Sand Creek, 12 miles south of Steveville, Alberta.

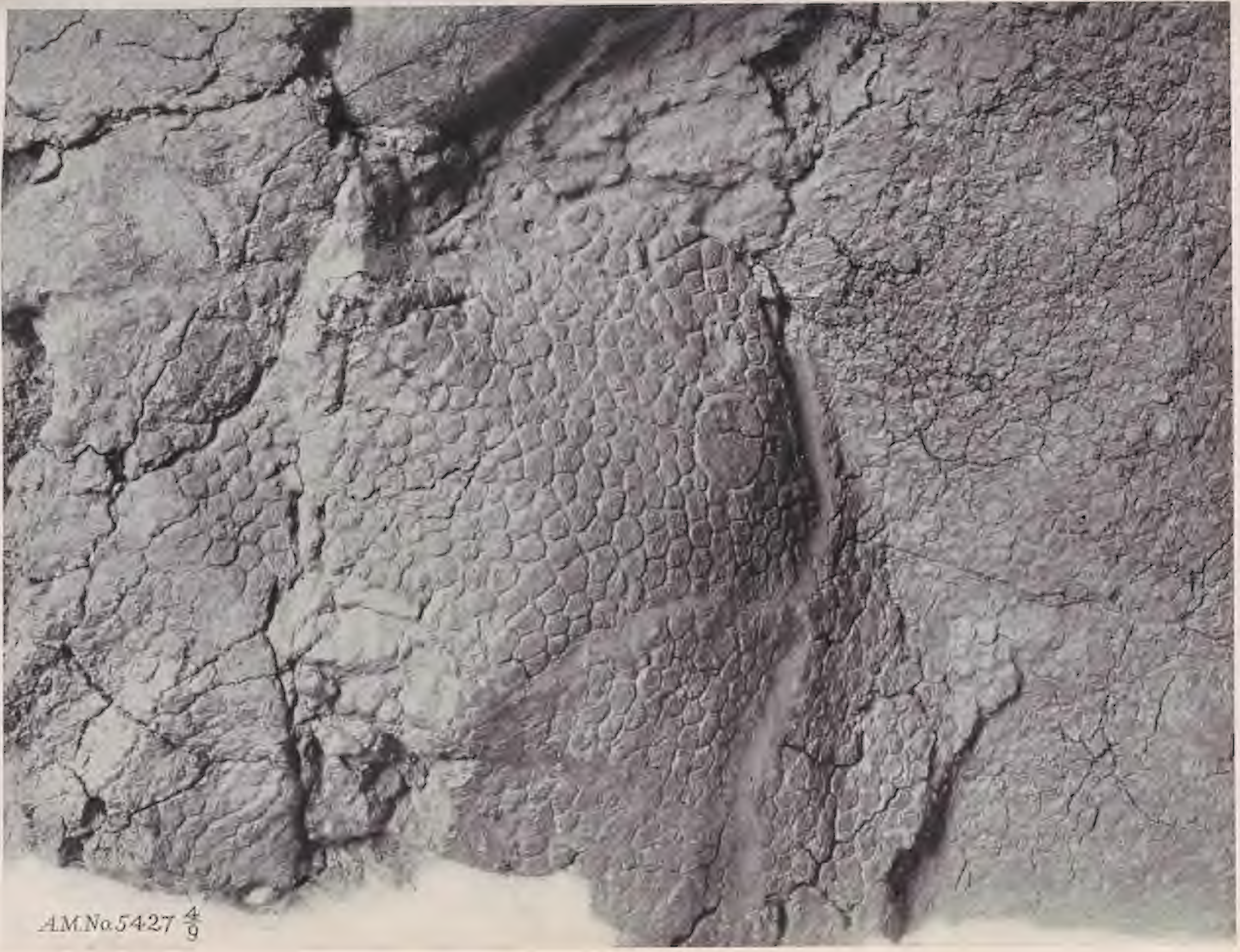


Monoclonius cutleri.

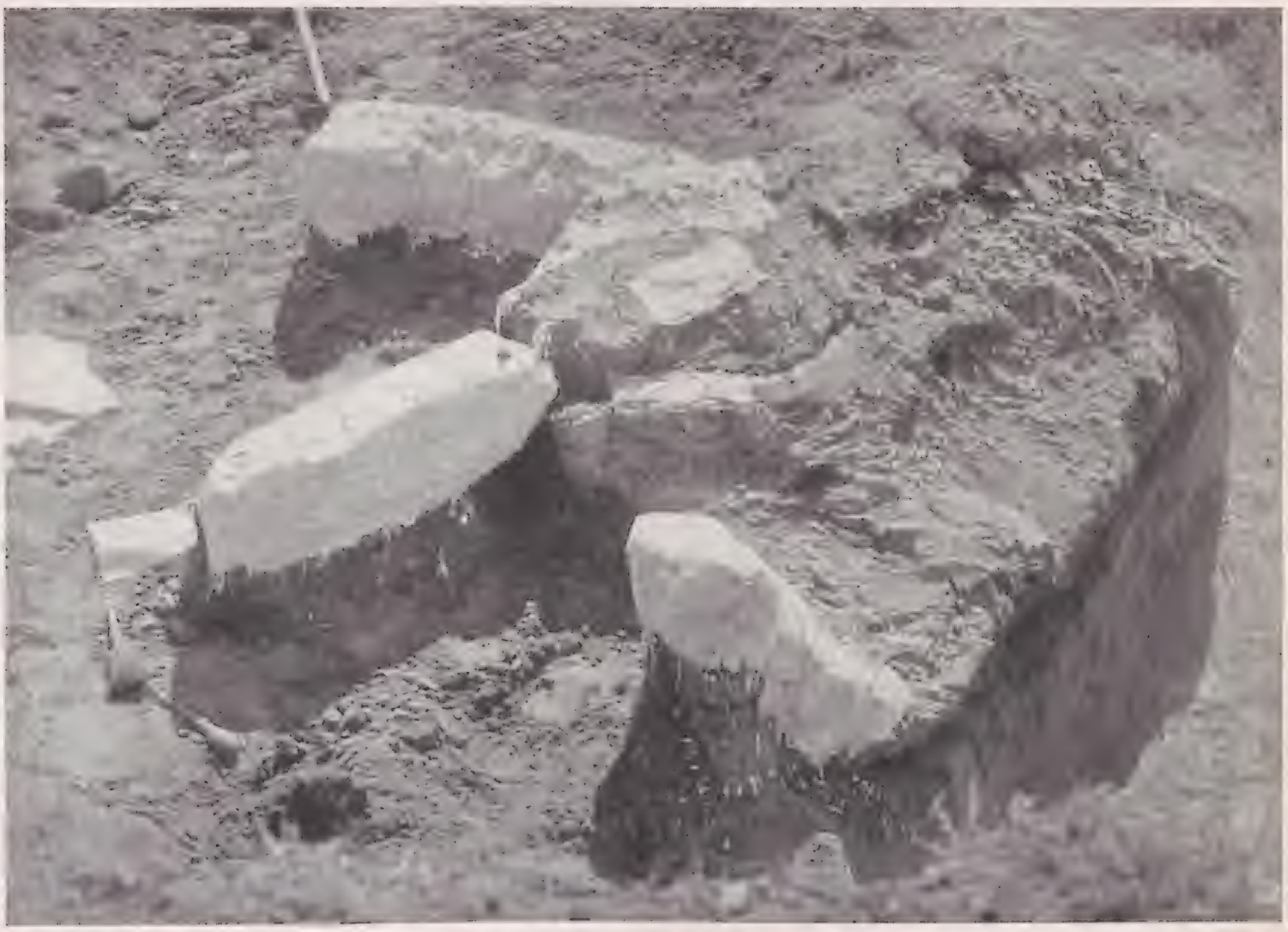
Dorsal view of type, No. 5427, showing patch of skin, posterior ribs in normal position, pelvis and vertebræ uncrushed.



MONOCLONIUS CUTLERI.
Ventral view of type, No. 5427.



MONOCLONIUS CUTLERI.
Detail of epidermal markings overlying the right femur, type, No. 5427.



MONOCLONIUS CUTLERI.

Excavation of skeleton, No. 5427, north fork of Sand Creek, 12 miles south of Steveville, Alberta.

56.85,1D:14.71

Article XI.— THE SKELETON OF DIATRYMA, A GIGANTIC BIRD FROM THE LOWER EOCENE OF WYOMING.

By W. D. Matthew and Walter Granger.

Plates XX–XXXIII.

Fossil birds are so rare that but little is known about their past history. Four famous discoveries have been made — first the *Archæopteryx* or Reptile-bird of the Jurassic, second the Toothed Birds of the Cretaceous, *Hesperornis* and *Ichthyornis,* third the Moas or Giant Ground-birds of New Zealand, fourth the *Phororhachos* of South America. These are the landmarks of fossil ornithology; they are the only extinct groups which are of any great importance in surveying the records of avian palæontology. There is a long list of names of fossil birds, but the rest all appear to be either near relatives of modern birds or of these extinct types, or are based upon such fragmentary remains that little can be said of their relationships.

To these four landmarks may now be added a fifth no less remarkable, no less important in the past history of birds. This is a gigantic ground-bird, equalling the Moas or the giant *Phororhachos* in bulk and resembling the latter in its huge head and enormous, high, compressed beak, but apparently only distantly related to it, and still more remotely related to the Moas and to the existing ratite birds (ostriches, cassowaries and rheas). It lived during the Lower Eocene, near to the beginning of the Age of Mammals, and was a contemporary and associate of the little *Eohippus* or Four-toed Horse.

In 1874 Professor Cope discovered in the Wasatch formation of New Mexico a few fragments of this gigantic bird, to which he gave the name of *Diatryma gigantea* in 1876,[1] and in 1911 Mr. Granger found certain fragments in the Eocene of Wyoming which were described by Dr. Shufeldt[2] under the name of *Diatryma ajax.* A toe bone from the Eocene of New Jersey, described by Marsh in 1894[3] under the name of *Barornis regens,* is referred by Dr. Shufeldt to *Diatryma.* Last summer Mr. Stein while collecting for the Museum in the Bighorn basin of Wyoming was so fortunate as to find a nearly complete skeleton of *Diatryma*, so that we now know for the first time what this extraordinary giant bird was like.

---

[1] Cope, 1876, Proc. Acad. Nat. Sci. Phila., p. 10; 1877, Ext. Vert. New Mex., p. 70, pl. xxxii, figs. 23–25.

[2] Shufeldt, 1913, Bull. Amer. Mus. Nat. Hist., Vol. XXXII, p. 287, pll. li–liv; 1915, Trans. Conn. Acad. Sci., Vol. XIX, p. 34, pll. i, ii, v.

[3] Marsh, 1894, Amer. Jour. Sci., Vol. XLVIII, p. 344, text figs.; Shufeldt, 1915, *l. c.*, p. 35, pll. i, v.

The discovery was wholly unexpected. Bird remains are among the rarest of fossils in the American Tertiary formations. During the past twelve years the American Museum has been conducting a systematic and persistent search, in charge of Mr. Granger, for fossil vertebrates in the Eocene and Paleocene formations. The search has been very successful in securing more or less complete skeletons of many of the more characteristic mammals, besides many skulls and thousands of more fragmentary specimens, such as jaws or parts of jaws. A few important specimens of fossil reptiles were also secured. But of fossil birds, great or small, only a very few and very fragmentary specimens were found, the most complete being a hind limb, and nothing so good as a skull, much less a skeleton, of any of them. In four seasons' work in the Bighorn basin of Wyoming, the richest field for Lower Eocene fossils, he obtained two fragments of the *Diatryma*, one consisting of a couple of phalanges or toe bones, the other part of the end of a metatarsus. No traces of it were found in any of the other western formations. The exploration of the badlands of the Bighorn basin had been practically completed, but one or two small areas had not been reached by previous expeditions and it was thought advisable to have Mr. Stein, one of the Museum's staff of experienced collectors, search these areas this past summer, and thus complete the work in this basin. As a result of the season's work he sent in the expected collection of fossil mammals mostly fragmentary, a few important specimens, and in addition this magnificent and quite unexpected bird skeleton.

At first glance it seemed probable that it was an ancestor or relative of the giant birds of the South American Tertiary, *Phororhachos* and its allies. But comparison of the skeleton soon showed that except for the gigantic size and the extraordinary proportions of the head and beak it had very little in common with that singular group. Nor on the other hand did it appear to have any near relationship with any other birds, living or extinct. The nearest in some respects were the emeus and cassowaries of Australia and New Guinea, especially the extinct *Genyornis* of the Australian Pleistocene,[1] although the huge head and short, thick neck contrasted with the small heads and slender necks of all living "ratite" birds, ostriches, rheas, moas etc., and it much exceeded any of them except the moas in bulk of body and massiveness of limbs. Yet its true affinities appeared to be not with the ratites but with the carinate birds, and a consideration of its points of likeness and unlikeness to *Genyornis*, which is most like it in size and proportions, confirms the view that *Diatryma* is derived from carinate, not from ratite ancestry. There was no suggestion even of remote relationships with the toothed birds of the Cretaceous, either with *Hesperornis* which is said to be remotely related to the modern loons and grebes, or with *Ichthyornis* similarly associated with the modern gannets, cormorants and frigate birds. Nor do the penguins, the auks, the dodo or any of the other outstanding groups of birds afford any nearer basis for comparison.

---

[1] Stirling and Zietz, 1901, 'Fossil Remains of Lake Callabonna.' Mem. Roy. Soc. S. Aust., Vol. I, Pt. II, pp. 41–80, pll. xix–xxiv; 1913, ibid., Pt. IV, pp. 111–126, pll. xxxv–xxxix.

The only bird with which *Diatryma* seems to show any real affinity is the Cariama or 'seriema' of South America, which is regarded as a very primitive type of carinate and whose affinities have been much disputed, but are now considered as with the cranes (Gruiformes).[1]

The skull and jaws.

The skull is of huge size for a bird, seventeen inches in length as preserved, the greater part made up of an enormous compressed beak six and a half inches high and nine inches long. The lower jaw is correspondingly massive and powerful. It is very different from that of any modern bird, the parrots and other powerful billed types approaching it in some degree, but far from equalling its proportions. The bills of toucans and hornbills are of quite different type. It is superficially like the skull of the extinct *Phororhachos* of the Miocene of South America, but the resemblance apparently does not involve any near relationship.[2] The proportions of the beak are much as in *Phororhachos* except that it lacks the decurved tip. The beak is entirely toothless, and had no groove or pits such as are seen in *Gastornis* of the Cernaysian (Paleocene) of France.[3] In the extinct Australian *Genyornis*[4] the beak is also massive, but not high or compressed, more of the proportions of *Dromæus* to which it was related.

The *anterior nares* are remarkable for their small size, somewhat exaggerated perhaps by crushing but nevertheless unusual. They are situated about two inches in front of the orbit and somewhat nearer to the lower than to the upper border of the beak. The openings are directed forward and a short furrow extends in front of them on the surface of the beak; they are apparently separated by the median septum. They show some analogy to the crows, especially the large billed raven *Corvultur*, in this respect; in the parrots and cockatoos the nares are also restricted and surrounded by bone, but open more outwardly. In *Phororhachos* the nareal openings are directly in front of the orbit and close to the upper margin of the beak; in *Gastornis* their lower anterior border is much further forward and nearer

---

[1] So adjudged by Stejneger, 1885, Standard Natural History, Vol. IV, p. 119; Pycraft, 1910, 'A History of Birds'; Gadow, Encycl. Brit., art. Bird, etc.

[2] Comparisons made with the figures and descriptions of Ameghino 1895, Bol. Inst. Geog. Arg., Vol. XV, cah. 11, 12, and especially with Andrews, 1899, Trans. Zool. Soc. London, Vol. XV, pp. 55–86, pll. xiv–xvii; also with skeletons of *Pelecyornis* and fragmentary material of *Phororhachos* in the American Museum collections.

[3] See Lemoine, 1878, 'Recherches sur les Oiseaux Fossiles des Terrains Tertiaires Inferieurs des Environs de Reims,' Pt. I, pp. 1–69, pll. i–v; 1881, *ibid.*, Pt. II, pp. 75–170, pll. vi–xi.

[4] Stirling and Zietz, 1913, *l. c.*, pl. xxxvi.

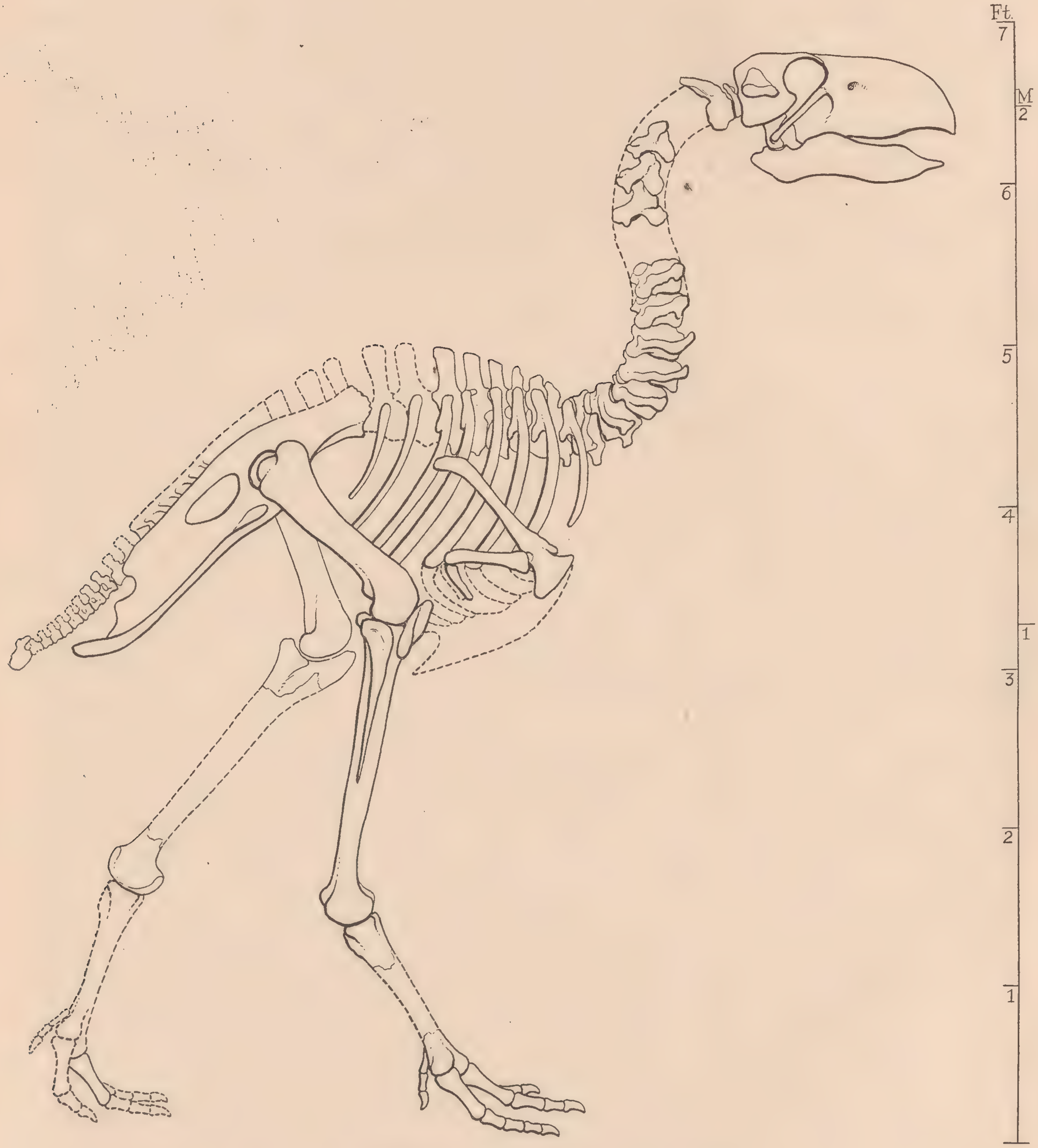


Fig. 1. Reconstructed skeleton of *Diatryma steini*. × $\frac{1}{17}$.

the lower margin, but otherwise they are unknown. The upper border of the beak is not thickened in *Diatryma* as it is in *Phororhachos.*

The *orbit* has a heavy, prominent crest of bone above and behind it, not present in *Phororhachos,* and the whole upper half is surrounded by a rather prominent bony ring. This ring does not appear to extend around the lower border of the orbit as it does in the parrots. A broad bony bridge connects the postorbital with the squamosal bone of the skull, making a separate *upper temporal fenestra,* a feature of the skull in many reptiles, but rare in birds. This is also seen in some of the parrot family (cockatoos); but the bridge or "supratemporal arcade" in *Diatryma* is much broader and more massive. It is not regarded as a primitive character inherited from reptilian ancestry, but as a secondary specialization correlated with the development of powerful jaw (masseter) muscles, as is the case with the cockatoos. The *jugal* (quadratojugal) is for a bird rather short and stout with a noticeable sigmoid curvature. It has the usual relations with the quadrate; the maxillary socket is situated at the posterior border of the maxilla but at a considerable distance above its lower border.

The *quadrate* is large, short and stout, with broad, flat orbital process, a single head but with two distinct facets upon it, short, thick neck (otic process) and body, wide and massive articulation for the lower jaw. In the ratite birds the quadrate has but a single head, and is bound in externally by the zygomatic process of the squamosal which overlies it closely so that it is almost immovable. In nearly all other birds it is articulated to the skull by two well separated heads, each upon a distinct neck, and is more free to move, the zygomatic process not overhanging its external face. *Diatryma* appears to be intermediate between the two types, as the two facets for the skull are distinct although conjoined to a single head; and although the zygomatic process does not tie it in as among the ratites the head is buried in a deeply excavated socket surrounded by a heavy border of bone. In *Phororhachos* the quadrate has two well separated heads; in the Cariama the head is single but expanded transversely with two distinct facets on the squamosal, not clearly separated on the quadrate; in neither is the socket so deep as in *Diatryma.* The quadrate of *Genyornis* is single-headed but of quite different type with slender neck and quite small, round head with a single facet for the squamosal. *Genyornis* is typically dromæognathine as *Phororhachos* is typically euornithic; *Cariama* may represent a survival of a very primitive condition among Euornithes, and *Diatryma* a specialization from a somewhat similar stage.

The under side of the skull is much disturbed by crushing so that the exact relations of the bones are not easily distinguished. The palate is very narrow, and almost completely roofed over, by the premaxillæ, the large and long palatine plates of the maxillæ and the palatine bones. The vomer and pterygoids are not fully recognized but it appears certain that they were reduced in size and that the vomer took no part in the palate roof. The palatines on the other hand are large, stout bones with a heavy inferior border, and their maxillary plates meet in a median suture. They extend forward about five inches in advance of the posterior border of the beak. Posteriorly their articulation for the pterygoids appears to be condylar rather than sutural. The supposed pterygoid is displaced and crushed; it is short and flattened, about two inches long and an inch and a quarter wide with distal articulations at each end which appear to accord with the palatine and quadrate facets for this bone. The maxillopalatines or palatal plates of the maxillæ also meet in a long median suture. The structure of the palate agrees therefore with the Euornithes (Neognathæ) or so-called "Carinate" birds and differs from the Dromæognathæ (Palæognathæ) or "Ratite" birds.[1] It is an extreme example of the desmognathous or roofed palate shown in varying degree by several groups of carinate birds. *Phororhachos* and *Cariama* are both desmognathous, but the latter by no means to this extreme.

The entire postorbital portion of the skull is remarkably short, in contrast to *Gastornis,* and rather in contrast to *Phororhachos,* but as in that genus the occiput is broad and well defined with strong occipital and lambdoidal crests (absent in *Gastornis*). The paroccipital process and post-tympanic crest are very prominent, stout and massive; the condyle is large, the foramen magnum small in proportion and the brain-case so far as we can judge from the crushed specimen had the relatively small capacity that one would expect in a bird of such huge size and great antiquity.

The lower jaw is extraordinarily massive, much heavier and deeper than in *Phororhachos* although not so long as in *P. longissimus.* It is comparable in proportions rather with the parrots and cockatoos. The two rami are solidly united into a long spout-shaped symphysis ending in a rather slender tip; the coronoid region is massive and prominent with a large strongly marked muscular scar on its outer side, and the angular process is very large and stout. In *Genyornis* the lower jaw is unusually deep but the symphysis is quite short and the powerful processes of coronoid and angular are not indicated. The few fragments of the jaw of *Gastornis* are of quite different type, with short symphysis, grooved and pitted upper border, etc.

---

[1] The terms Dromægnathæ and Euornithes of Stejneger are earlier than Palæognathæ and Neognathæ of Pycraft and although not wholly equivalent they are more convenient for the present comparison, as *Ichthyornis, Hesperornis* and the penguins are excluded from the Euornithes, but included in Neognathæ. The terms ratite and carinate are used as structural terms, neither corresponding with a primary natural group or evolutionary stage of birds.

The vertebral column.

The vertebræ are short and extraordinarily massive throughout, as the great size of the skull would require. Unfortunately the series is not complete. One vertebra at least is missing behind the axis, and one or more about the middle of the neck. There are probably one or more dorsal vertebræ missing and there may be one caudal lost. Otherwise the series is believed to be complete, but as the vertebræ were disarticulated and somewhat crushed in various directions, there is some uncertainty as to their exact sequence. Eighteen presacrals are preserved and nine caudals besides the pygostyle.

Eleven cervicals or neck vertebræ are preserved, and as at least two more, probably three, are missing, there must have been at least thirteen, probably fourteen. We have the atlas, axis, a series of three anterior cervicals and a series of six posterior cervicals. The axis and anterior cervicals are remarkable for the great reduction of the centrum which is little more than a thick, short plate compressed laterally and not expanded at the articular facets. The chief bulk of the vertebra is composed of the massive spreading zygapophyses with large flat, rounded facets. There are no neural spines and the transverse processes and cervical ribs are quite vestigial, represented only by a small knob below the anterior zygapophysis with a little backwardly directed spine. The posterior cervicals have short, wide centra, flaring moderately at the anterior facets, and expand laterally into great wing-like transverse lamellæ pierced by the large vertebrarterial foramen, the outer and lower part of the wings being formed of the coössified cervical ribs. The zygapophyses are still massive and their facets large, round and plane; they are no longer horizontal, but the anterior pair pitch progressively inward to an angle in the last cervical of about 45° from vertical. The next to the last cervical has a short bifid hypapophysis; the last has a longer single compressed spine-like hypapophysis.

Seven dorsal vertebræ, distinguished as such by having separate ribs, are preserved. The first two are like the cervicals in that they have no spines and large, round, plane, zygapophysial facets. Their rib facets are small, especially the first, and the ribs were undoubtedly unattached to the sternum. The last five dorsals have neural spines, stout and progressively increasing in height, while the transverse processes pitch strongly upward, are stout and carry large rib facets. The hypapophyses are progressively reduced; the last two vertebræ preserved have none. The zygapophysial facets are much smaller, narrow, oval and pitch strongly inward. The centra of all the dorsals are extremely short with widely flaring anterior afects. The articulations of the centra of all the vertebræ behind the axis are of the usual saddle-shaped or heterocœlous type throughout.

The synsacrum is unfortunately much damaged so that the upper portion is mostly gone. It is remarkably short anteriorly, and posteriorly it does not extend more than about three-fifths the length of the postacetabular portion of the pelvis. Apparently it does not include more than two vertebræ in front of the true sacrals; the number behind the true sacrals we have not determined, but the last one is imperfectly coössified, while the first two free caudals appear to be on the verge of coössification to the sacrum. The arches and spines are missing so that we cannot tell whether or not the very considerable height of spine of the last dorsal extended through the sacral vertebræ as it does in the Dromæognathæ;[1] but the shortness anteriorly and tendency to elongate and consolidate posteriorly is a characteristic feature of the ostrich and rhea.

The *caudal vertebræ* are nine besides the pygostyle; one or more may be missing, but the first two, of which only the centra are preserved, are similar to the last sacral, and their facets are imperfect as though they might coössify later in life. The remaining caudals have shorter centra, about as wide as long, short stout spines and vestigial transverse processes. The pygostyle is a flat vertically compressed ovate bone with a large bifid process, antero-superior, if our orientation be correct,[2] much as in the ostrich.

The *ribs* are very flat, thin and wide, with capitulum and tuberculum widely separated and extended upon long necks. Their proportions agree fairly well with those of the cassowary but they are about twice as large in all dimensions. The uncinate processes appear to be either highly vestigial or completely absent — as in *Palamedea.* The sternal segments of the ribs carry about the same relations as in the cassowary.

The *sternum* has not been found. Possibly there may be parts of it unrecognized as yet among the weathered fragments of the skeleton. We may infer from the fact that the coracoids meet in front of it in the median line that it was narrow anteriorly as in *Cariama,* unlike the ratites, and from the great reduction of the wing bones and from the characters of the pectoral girdle that it had no keel, like the ratites and unlike *Cariama.* The sternum of *Phororhachos* has not been described.

The shoulder-girdle and fore limb.

The coracoid and scapula are solidly fused together, meeting end-on as in the ratite birds instead of at a sharp angle as in carinate birds. It is remarkably like that of the cassowaries, more so indeed than are the shoulder-girdles of any other ratites. *Phororhachos,* on the other hand, has a fully carinate type of shoulder-girdle; so does *Gastornis.*

---

[1] See Pycraft, 1900, 'Morphology and Phylogeny of the Palæognathæ and Neognathæ,' Trans. Zool. Soc. London, Vol. XV, pp. 211–4, 271.

[2] It is possible that it has been placed upside down. The surface is somewhat damaged by weathering.

The *coracoid* is short, wide and much flattened, its width and length approximately equal. The procoracoid appears to be absent or vestigial; in addition to the usual border for articulation with the sternum there is a small articular facet on the coracoid, apparently for its fellow of the opposite side. In *Cariama* the coracoids almost meet in the median line, being separated only by a narrow splint of bone from the sternum.[1]

The *scapula* has the usual elongate blade, oval in cross-section, flattened and somewhat broadened towards its distal end, and with a rather long, stout, overhanging acromial process.

The *clavicle* may be fused to the tip of the acromial process; if not it is wholly absent as there is no facet for a separate bone.

The resemblance of this shoulder-girdle to that of the emeu-cassowary group is very marked. But in view of the evidence from other parts of the skeleton it would seem that it must be ascribed to parallelism or convergence, not to affinity. If so the resemblances between the shoulder-girdles of the several groups of ratite birds, which are by no means so close, must à fortiori be ascribed to the same agency. This strengthens the case for the polyphyletic origin of the ratite birds.

The *humerus* is reduced to about the same proportion as among the cassowaries; the proximal end is relatively wide and flattened, the distal end narrow and very little expanded at the articular surfaces which are obscurely shown.

The *radius* is doubtfully recognized in a small rod-like bone about as long as one's finger but much slenderer, with the ends not expanded, the facets small and obscure, the supposed distal facet quite oblique.

No other wing bones are recognized.

The pelvis.

The pelvis as a whole is large, very short in front of the acetabulum, broad and long posteriorly. It is articulated in position with the synsacrum but unfortunately the upper part had been much damaged by weathering before fossilization and crushing afterwards, so that some of its important features cannot be determined. It is clear, however, that it is of the euornithic type. The *ilium* and *ischium* are solidly coössified save for the usual foramen near the anterior end; they extend much beyond the posterior end of the synsacrum, the lower border of the ischium extending nearly to the posterior end of the pelvis. The *pubis* is a long curving rod-like bone somewhat appressed to the ischium and loosely sutured to it behind the obturator foramen but nowhere coössified, and extending beyond the posterior border of the ischium backwards and inwards towards the median line. Its distal portion is somewhat broadened and thickened. The anterior blade of the ilium is almost wholly lost and its posterior plate is incompletely preserved, so that it is not possible to determine whether the ilia met in the middle line anteriorly, but posteriorly the distinctness of the transverse processes of the synsacral vertebræ seem to indicate that the ilia did not extend wholly over them to the middle line but were separated by a pelvic escutcheon of moderate width.

---

[1] Compare conditions in the several ratite types as contrasted by Pycraft, 1900, Morph. Phyl. Palæognathæ, p. 274.

This type of pelvis differs notably from that of any of the dromæognathine birds in construction, although affording some points of resemblance in proportions. The Dromæognathæ all have the ilium well separated from the ischium and the pubis usually from both.[1] The Euornithes have the ilium and ischium solidly coössified beyond the short ilio-ischiadic foramen, and the pubis slender, closely applied to the ischium and either extending beyond it backward and inward or else more or less vestigial and closely coössified with it.

The nearest ally in structure of the pelvis that we have been able to find among modern birds is the South American *Cariama*. The *Diatryma* pelvis might well be a derivative of this type except that in *Cariama* the anterior portion is decidedly longer, the synsacrum having been extended forward, while the pubis is vestigial, almost thread-like, and the whole post-acetabular portion is shorter. In the essentials, however, the agreement is fairly close, and it is important to note that *Cariama* is regarded as representing an extremely primitive type of the Euornithes, although related to the cranes and in a lesser degree to the Accipitres. The long heavy pubis suggests *Palamedea,* but in that genus the pubis is much more separate from the ischium, and there is little else to suggest any especial relationship to *Diatryma.*

The shortness of the anterior and elongation of the posterior regions of the pelvis are comparable with the ostrich and rhea, but in structure they are wide apart from *Diatryma.* *Phororhachos* has a quite different type of pelvis, which while euornithic in structure, and also compared by Andrews with that of *Cariama,* differs from the modern genus in almost an opposite direction from the differences seen in *Diatryma;* the anterior and posterior portions are more evenly balanced, the posterior portion is very narrow and the pubis quite vestigial. The pelvis of *Gastornis*, on the other hand, judging from the few fragments preserved, may have been of somewhat similar proportions to that of *Diatryma*, but the ischium is widely different.

---

[1] See Pycraft, *l. c.*, p. 276, for details.

The hind limb bones.

In general the hind limb bones compare with the more massive types of the moas in size and proportions, and especially with *Genyornis* the giant extinct emeu of Australia.[1] They are of much the size of the largest species of *Phororhachos* and of *Gastornis*, and considerably smaller than *Dinornis maximus*.[2] We have both femora complete, one tibia complete and both ends of the other, both fibulæ, one lacking the distal end, both ends of one metatarsus and all the phalanges of one foot. The only doubtful point in the reconstruction of the hind limb is the exact length of the metatarsus.

The *femur* is massive, fifteen inches long, six inches across the head (this measurement is probably exaggerated by crushing) and five inches across the condyles. The trochanter is very high and robust, the condyles massive, the outer one decidedly heavier and projecting considerably beyond the inner one. It is longer than in *Genyornis* and the moas, but hardly as massive; in *Phororhachos* the trochanter is not nearly so high or prominent; it agrees better with *Gastornis* than with any other type and allowing for the effects of crushing it may have agreed closely with *G. klaasseni* and *parisiensis*, less nearly with *G. edwardsi*.[3]

The *tibia* is nearly two feet in length, the cnemial ridge rising proximally into a high bifid process, the ectocnemial crest very prominent, compressed, and thickened at its border, the procnemial crest smaller, compressed and unusually distinct. The shaft is straight and the distal end nearly symmetrical, the tendinal bridge almost median, the distal condyles subequal. This tibia agrees very well with that of *Genyornis* in length, robustness, and the prominent cnemial crests, but the shaft is somewhat straighter in *Diatryma* and the cnemial crests more compressed and more deeply separated. These differences may, however, be exaggerated by crushing. In the moas the cnemial crests appear to be still less prominent or distinct, the extensor bridge more internal in position. In *Phororhachos*, as also in *Cariama*, the crests are much compressed but the procnemial is the more prominent of the two and the tibia is longer. The agreement with *Gastornis klaasseni* and *parisiensis* appears to be again quite close, allowing for the crushing of the *Diatryma* tibia.

---

[1] As described by Stirling and Zietz, *l. c.* (footnote 4) and also by comparison with hind limb bones of this genus in the American Museum.

[2] Compared with the mounted skeleton in the American Museum collection.

[3] See Lemoine, *l. c.*, and Newton, 1886, Trans. Zool. Soc. London, Vol. XII, pp. 143–157, pll. xxviii, xxix, for comparison with hind limb bones of *Gastornis*.

The *fibula* is slender and comparatively long, comparable with the Dinornithidæ; in *Genyornis* it is shorter, only nine inches in length and thickened beyond the middle of the shaft. In *Phororhachos* the fibula is much shorter in the shaft.

The *metatarsus* is unfortunately incomplete, the shaft being lost through weathering. The proximal and distal ends have been pieced together from fragments, so that they are almost complete. Cope's type of *Diatryma gigantea* consisted of the proximal end and two distal condyles of the metatarsus and it is upon the close agreement with this type that we base our reference of the skeleton to his genus. The perforation of the shaft near the proximal end by which the name *Dia-tryma* was suggested is shown in our specimen, and the form and relations of the tibial facets are in close agreement. The distal condyles also agree in proportions, the shallow grooving, and various details, and the third (inner) condyle which was associated with the type by Shufeldt also agrees with ours except that it is more reduced in size. This feature with slightly larger size and other minor differences are the grounds for regarding the skeleton as a distinct species from *D. gigantea*. It comes from a rather distant locality, Cope's type being from the New Mexican Wasatch, and our skeleton belongs in a somewhat older faunal zone, so that the less reduction of the lateral digits might be expected.

In the moas the three digits are of almost equal size. In *Genyornis* the relative size of the three digits is much as in *Diatryma*, but the lateral digits are not grooved while the median digit is more deeply grooved. In *Phororhachos* the metatarsus is much longer, the two lateral digits about equally reduced.

The *phalanges* are of moderate length and somewhat flattened, especially those of the third digit. The third digit is the largest, the fourth a little smaller, the second smaller than the fourth, while the first is much smaller than the second. The vestigial first metatarsal is doubtfully identified, the corresponding first phalanx and claw more certainly so. The unguals are rather short, triangular in cross-section, pointed and moderately curved; they are of quite different type from the longer, more curved unguals of *Phororhachos*, which are round in cross-section, and they are no less different from the short, rather flattened unguals of the moas.

On the whole, the structure of the hind limb and foot, while presenting many differences of detail from all the great ground birds living or extinct, affords very little to indicate the broader affinities of *Diatryma*. It would take a more thorough knowledge than we possess of the osteology of birds to decide from the hind limb bones alone where its nearest relationships lay.

SUMMARY OF CHARACTERS.

Diatryma was a gigantic bird, ground-living and with vestigial wings. In bulk of body and limbs it equalled all but the largest of the moas and surpassed any living bird, but was not so tall as an ostrich. The height of the reconstructed skeleton is nearly seven feet. The neck and head were totally unlike any living bird, the neck short and very massive, the head of enormous size with a huge compressed beak much like that of the extinct *Phororhachos* but very different from that of any living bird, and in striking contrast to the small head and slender neck of the living ratite birds.

The construction of the skeleton indicates that despite some resemblances to the ratite birds, *Diatryma* is more nearly related to the Euornithes, and in particular to the modern *Cariama* of South America. It may perhaps be regarded as a very ancient offshoot from the primitive carinate birds of which *Cariama* is a modern survival. Although it resembles the extinct South American *Phororhachos* in size and proportions and was probably of similar habits it does not appear to have been at all nearly related to it and was certainly not in any degree ancestral. Both were gigantic ground birds with enormous heads and high compressed beaks, and the proportions throughout are considerably alike, but they appear to have been independent specializations from primitive carinate birds, *Diatryma* a much more ancient one, *Phororhachos* arising at a much later date. The modern *Cariama* may represent broadly the primitive carinate type from which both were derived. *Phororhachos* although a much later type than *Diatryma* has not gone so far in its adaptive specialization; that is, its convergent resemblances to the ratite birds are not so close, and it shows less departure from the typical carinate birds, in shoulder-girdle, pelvis, hind limb characters, etc. It must be derived from a much later and presumably higher stage in the evolution of the typical euornithine stock. If *Cariama* accurately represented that normal stock, then *Phororhachos* should be in all respects nearer to it than *Diatryma;* but aside from its less extreme adaptive specialization this does not seem to be the case. More probably *Phororhachos* is a derivative of some extinct Eocene type of normal adaptation allied to the Eocene ancestors of *Cariama,* while *Diatryma* would be a derivative of normal Cretaceous Euornithes allied perhaps more closely to the ancestral line of *Cariama.*

The relations of *Diatryma* to *Gastornis* are a more difficult problem. *Gastornis* is a gigantic ground bird whose remains have been found in the Lower Eocene and Paleocene of France, England and Belgium. It was first described from limb bones found in the Suessonian or Lower Eocene, where it is accompanied by fossil mammals very nearly related to those found with *Diatryma.* But it is chiefly known from the referred species *G. edwardsi* of which a fragmentary skull and various skeleton bones were described from the older Cernaysian formation by Doctor Lemoine.[1] The skull is of gigantic size, like those of *Diatryma* and *Phororhachos,* but is widely different from either in construction, so far as one can judge from the fragments preserved. The skeleton, if Dr. Lemoine has correctly associated the various bones, is also widely different, especially in the shoulder-girdle, from our Wasatch genus. If these skull and skeleton fragments are truly related to the Suessonian *Gastornis* limb bones, then the genus has no affinity to *Diatryma.*

But it is possible that the Cernaysian *G. edwardsi* is not nearly related to the Suessonian *G. parisiensis* and *klaasseni,* and it is also possible that the various bones associated by Lemoine under the name of *G. edwardsi* do not all belong with the hind limb bones which form the type of his species. They come from various localities near Rheims, and were referred apparently upon the basis of suitable size and character, no two of them belonging to one individual, save that the fragments of skull and jaws are believed to be all of one individual.

It is very desirable that the *Gastornis* remains be revised with a view to a possible reconstruction of the skull and reconsideration of the associations as above suggested. We hope that our European confrères may find this practicable in the near future. But it is quite clear that the *Gastornis* skull represents a gigantic ground bird, similar in adaptation to *Diatryma,* and only slightly older, but not nearly related; and that *Phororhachos* represents a third similar adaptation, also independent and of much later age.

Systematic Position.

Cariama is placed by all modern authors in the Gruiformes, but considered evidently as a primitive and marginal member of the order. The systematic position of *Phororhachos* is disputed; some authors appear disposed to place it in the Gruiformes on account of its relationship to *Cariama;* others are disposed to maintain the Order Stereornithes in an amended sense to include *Phororhachos* and its allies. But it does not appear reasonable to us to include a type of such extreme specialization and great antiquity as *Diatryma* with the Gruiformes merely because of a necessarily remote relationship to a primitive member of that order. The common ancestral stock must necessarily date far back in the Cretaceous, very likely antedating the earliest separation of various other orders from the primitive euornithic stock. And the extreme specialization affords obvious structural distinctions which are elsewhere considered as of high rank in the classification of birds.

---

[1] The Cernaysian mammal fauna is not closely related to that of the Suessonian and Wasatch, and is regarded as of equivalent age to the Torrejon fauna of the American Paleocene.

It appears necessary therefore to place *Diatryma* in a new order and family, as it differs too fundamentally from the Gastornithes and Stereornithes to fall into either order and is but remotely related to any other known group of birds. They may be defined provisionally as follows:

Order DIATRYMÆ.

Euornithine birds, holorhinal, with desmognathous palate; the quadrate with imperfectly double head; pterygoid short, movably articulated to palatine and quadrate; palatines large, taking part in palatine roof; vomers reduced or vestigial; the zygomatic process of the squamosal not overhanging quadrate but united with postorbital bar into a superior temporal arcade; orbits open inferiorly. Wings more or less vestigial; scapula fused with coracoid and scapulo-coracoid angle approximating 180°; coracoid a short, broad, expanded plate; no procoracoid; clavicle vestigial or absent. Pelvis wide and long posteriorly; ischium united to ilium save for a short foramen; pubes long, appressed to lower border of ischium, arching inward beyond its posterior tip. Feet tetradactyl; the first digit reduced, ?opposed.

Family DIATRYMIDÆ.

Skull greatly enlarged with powerful compressed beak; heavy jaw; broad supratemporal arcade; quadrate head socketed in a deep fossa; occiput broad with prominent crest; palate narrow, very completely roofed over. Neck short and very powerful. Wings greatly reduced; coracoids meeting in front of scapula. Pelvis very short anteriorly, broad and long posteriorly with heavy pubes nearly meeting behind. Hind limbs large and stout; feet with vestigial first digit; second digit smaller than fourth; third the largest. Unguals rather short and moderately curved, triangular in cross-section with a deep groove upon one side.

Genus **Diatryma** *Cope*.

Gigantic and massively proportioned, the beak like that of *Phororhachos* but lacking the decurved tip. Anterior nares small, situate about two inches in front of orbit and midway between top and bottom of skull. Lower jaw much heavier than in *Phororhachos* with powerful coronoid and angular processes, long symphysis rather slender anteriorly. Anterior cervicals articulating mainly through their zygapophyses, the centra much reduced. Posterior dorsals with massive and moderately high spines. Limb bones comparable to those of the moas in size and proportions.

The above analysis of the ordinal, family and generic characters is necessarily tentative as no other genus than *Diatryma* is known. Four described species.

D. gigantea Cope. Lower Eocene (Lower Wasatch) of New Mexico. Type, proximal and distal ends of metatarsus. Outer digit considerably reduced.

D. ajax Shufeldt. Lower Eocene (Basal Wasatch) of Wyoming. Type, part of distal end of metatarsus. Size one-fourth greater than *D. gigantea.*

D. steini sp. nov. Lower Eocene (Lower Wasatch) of Wyoming. Type, a skeleton nearly complete. Lower Eocene, Gray Bull horizon, Wasatch formation, S. Elk Creek, Bighorn basin, Wyoming. Found by William Stein of American Museum Expedition of 1916. Amer. Mus. No. 6169. Size of *D. gigantea,* outer digit less reduced.

?*D. regens* (Marsh). Eocene, New Jersey. Type, a proximal phalanx. Referred provisionally on authority of Shufeldt, but practically indeterminate.

General Conclusions.

In conclusion a few words may be permitted as to the bearing of this new discovery upon the general lines of avian evolution.

It has been made sufficiently clear that *Diatryma* stands well apart, widely separated from any other group of birds. It shows a number of unique features, some adaptive, some more probably primitive, in the skull and skeleton. Although paralleling *Phororhachos* in adaptation it is evidently quite unrelated, and its resemblances to the ratite birds appear to be largely, if not wholly, conditioned by similar adaptation.

But its isolated position would hardly have been suspected had we known only the limb and foot bones. Such authorities as Cope regarded it as a relative of the rhea, and Shufeldt of the ostrich, and neither had any suspicion of its extraordinary characters — nor does it seem likely that a complete knowledge of the hind limb bones would have materially altered their concept of its form and near affinity to the ratites. Lucas suggested its affinity to *Phororhachos* partly upon the ground of faunal dispersal,[1] but this suggestion, while implying a view of probable skull proportions and adaptation that has been strikingly verified, appears also wide of the mark as regards any real affinity. Yet a plausible argument could have been maintained for this view too, had we known no more than the hind limb of *Diatryma;* and had we had to deal with an incomplete and badly preserved skull it would have been regarded as well proven.

---

[1] Lucas, 1903, Proc. U. S. Nat. Mus., Vol. XXVI, p. 556.

Now with very few exceptions all our knowledge of the older Tertiary and Cretaceous birds is based upon very fragmentary material, most of it upon fragments of the hind limb or foot or of the humerus. These fragments have been named and compared to modern forms, referred to modern families, often to modern genera. The recorded geological range of these genera is thus supposed to extend backward into the early Tertiary or even into the Cretaceous. In one instance a bird from the marine Cretaceous is referred by Shufeldt to an existing species of grouse. The modern types of birds thus have apparently an antiquity of origin in striking contrast with the modern types of Mammalia. No modern genus of mammals extends back further than the Miocene; most of them originated later. Most of the modern families originated in the middle or later Tertiary; with the possible exception of the Didelphidæ and Centetidæ none are of pre-Tertiary origin. Setting aside *Archæopteryx,* the five types among the older birds which are adequately known — *Hesperornis* and *Ichthyornis* of the late Cretaceous, *Gastornis, Diatryma* and *Gallinuloides* of the Eocene, are very far from being nearly related to the modern birds which they resemble in adaptation. But nevertheless the fragmentary evidence has apparently given a widespread impression of the antiquity of differentiation of the modern bird types. This appears to have no sound foundation. Theoretically it ought not to be so. It is true that certain well known reptilian and lower types, such as crocodiles, turtles, etc., have persisted from the beginning of the Tertiary to the present day with very little alteration, the changes hardly amounting to generic, much less family value. These, however, are, so-to-speak, dead groups. They are and have been during that time strictly limited to a narrowly circumscribed range of adaptation and environment. On the contrary the birds are, like the mammals, of widely varying adaptation, a highly progressive, adaptable class of animals, and we should expect them to exhibit a good deal of parallelism to mammals in the broad features of their evolutionary history. It seems probable that this was the case, that the modern genera of birds did not in reality appear earlier than the modern genera of mammals, and that if we knew more about the early Tertiary birds we should find that they were not nearly so close to modern genera as they have been supposed to be. So far as we can judge from the analogy of fossil mammals, we would suspect that fragmentary remains of Eocene birds referred to the modern cranes, grouse, eagles or owls, were more probably similar adaptations no more related to the modern types than *Didymictis* to *Viverra* or *Patriofelis* to *Felis,* while the true lines of ancestry of modern bird types may well involve as wide a change in structure and habits as separates *Eohippus* from *Equus* or *Miacis* from *Canis.*

Shufeldt's recent revisions of the fossil birds of North America are of the greatest value in providing for the first time competent descriptions and excellent photographs of the numerous Tertiary and Cretaceous types which have hitherto been nothing but names. But he has shown very clearly the wholly provisional nature of all these identifications and the fragmentary and inadequate character of all the material. It is by no means desirable to change the provisional identifications, provided they are understood always as comparisons and not as positive references. But they afford no ground for concluding that the antiquity of modern groups of birds is greater than that of modern groups of mammals. Nor, on the other hand, does it appear that they were notably less ancient. *Diatryma* shows that the characters and differentiation of the Euornithes were already well established by the beginning of the Tertiary period, and they had passed decidedly and irrevocably beyond the more primitive stages preserved in the struthious birds, just as the placental mammals at the beginning of the Tertiary were already clearly differentiated from the marsupials. While the orders of birds, or some of them, may have originated in the Tertiary, the primary divisions must date well back into the Mesozoic as they unquestionably do among mammals. Gadow's conclusion (Encycl. Brit., art. Birds) that "The Ratitæ branched off, probably during the Eocene period, from that still indifferent stock which gave rise to the Tinami + Galli + Gruiformes, when the members of this stock were still in possession of those archaic characters which distinguish Ratitæ from Carinatæ" if it be accurate as to phylogenetic relations, places the differentiation at much too recent a date.

On the whole the evidence of the *Diatryma* seems to support the view that the evolution and differentiation of mammals and birds was largely similar in time and manner and conditioned by similar causes. That is to say, the Cenozoic was the era of the great expansion and dominance of euornithic birds as it was of placental mammals, of the progressive differentiation of the modern orders, then of the modern genera, finally of modern species. The Tertiary was the Age of Birds as it was also the Age of Mammals — only we shall never in our day have the evidence to prove it conclusively. But like the mammals, the birds originated long before the dawn of the Tertiary, probably very early in the Mesozoic, and the Euornithes, like the Placentals, were fully differentiated from the older groups by the end of the Cretaceous.

EXPLANATION OF PLATES XX TO XXXIII.

Diatryma steini, type specimen, Amer. Mus. Coll. No. 6169.

The quadrate and ?pterygoid are figured $\frac{1}{2}$ natural size; all other figures are $\frac{1}{4}$ natural size.

The presacral vertebræ are arranged and numbered in what is considered their proper sequence.

Photographs are by Mr. Albert Thomson; the restoration by Mr. Erwin S. Christman.

Plate XX. *Skull:* Fig. 1a, right side; 1b, left side; 1c, palatal view.

Plate XXI. *Mandible:* Fig. 1a, viewed from above; 1b, from right side; 1c, from below.

Plate XXII. Fig. 1. The *skull*, viewed from behind. Fig. 2a. *Quadrate*, anterior view; 2b, external view; 2c, inferior view; 2d, superior view. Fig. 3. *?Pterygoid.* Fig. 4a. *Atlas vertebra*, viewed from in front; 4b, from left side; 4c, from behind.

Plate XXIII. Fig. 1a. *Axis vertebra*, viewed from the front; 1b, from left side; 1c, from behind. Fig. 2a. *Anterior cervical vertebra*, viewed from above; 2b, from left side; 2c, from the front. Fig. 3a. *Anterior cervical vertebra*, viewed from above; 3b, from left side; 3c, from the front. Fig. 4a. *Anterior cervical vertebra*, viewed from above; 4b, from left side; 4c, from the front.

Plate XXIV. Fig. 1a. *Anterior cervical vertebra*, viewed from the front; 1b, from left side. Fig. 2a. *Posterior cervical vertebra*, viewed from in front; 2b, from behind. Fig. 3a. *Posterior cervical vertebra*, viewed from front; 3b, from behind; 3c, from below; 3d, from above.

Plate XXV. Fig. 1a. *Posterior cervical vertebra*, dorsal view; 1b, left side view; 1c, anterior view; 1d, posterior view. Fig. 2a. *Posterior cervical vertebra*, anterior view; 2b, posterior view. Fig. 3a. *Posterior cervical vertebra*, viewed from the front; 3b, from behind.

Plate XXVI. Fig. 1a. *Anterior dorsal vertebra*, viewed from the front; 1b, from behind. Fig. 2a. *Anterior dorsal vertebra*, viewed from the front; 2b, from behind. Fig. 3a. *Anterior dorsal vertebra*, viewed from the front; 3b, from left side; 3c, from behind. Fig. 4a. *Anterior dorsal vertebra*, viewed from the front; 4b, from left side; 4c, from behind. (The photographs for figures 4a and 4b were made before the hypophysis was attached).

Plate XXVII. Fig. 1a. *Posterior dorsal vertebra*, viewed from the front; 1b, from left side. Fig. 2a. *Posterior dorsal vertebra*, viewed from the front; 2b, from left side. Fig. 3a. *Posterior dorsal vertebra*, viewed from the front; 3b, from left side. Fig. 4a. *Caudal vertebra*, viewed from the front; 4b, from left side. Fig. 5a. *Caudal vertebra*, viewed from the front; 5b, from left side. Fig. 6a. *Pygostyle*, viewed from the front; 6b, from left side.

Plate XXVIII. Six *dorsal ribs* of the right side and (lower figures) the distal ends of four *sternal ribs.*

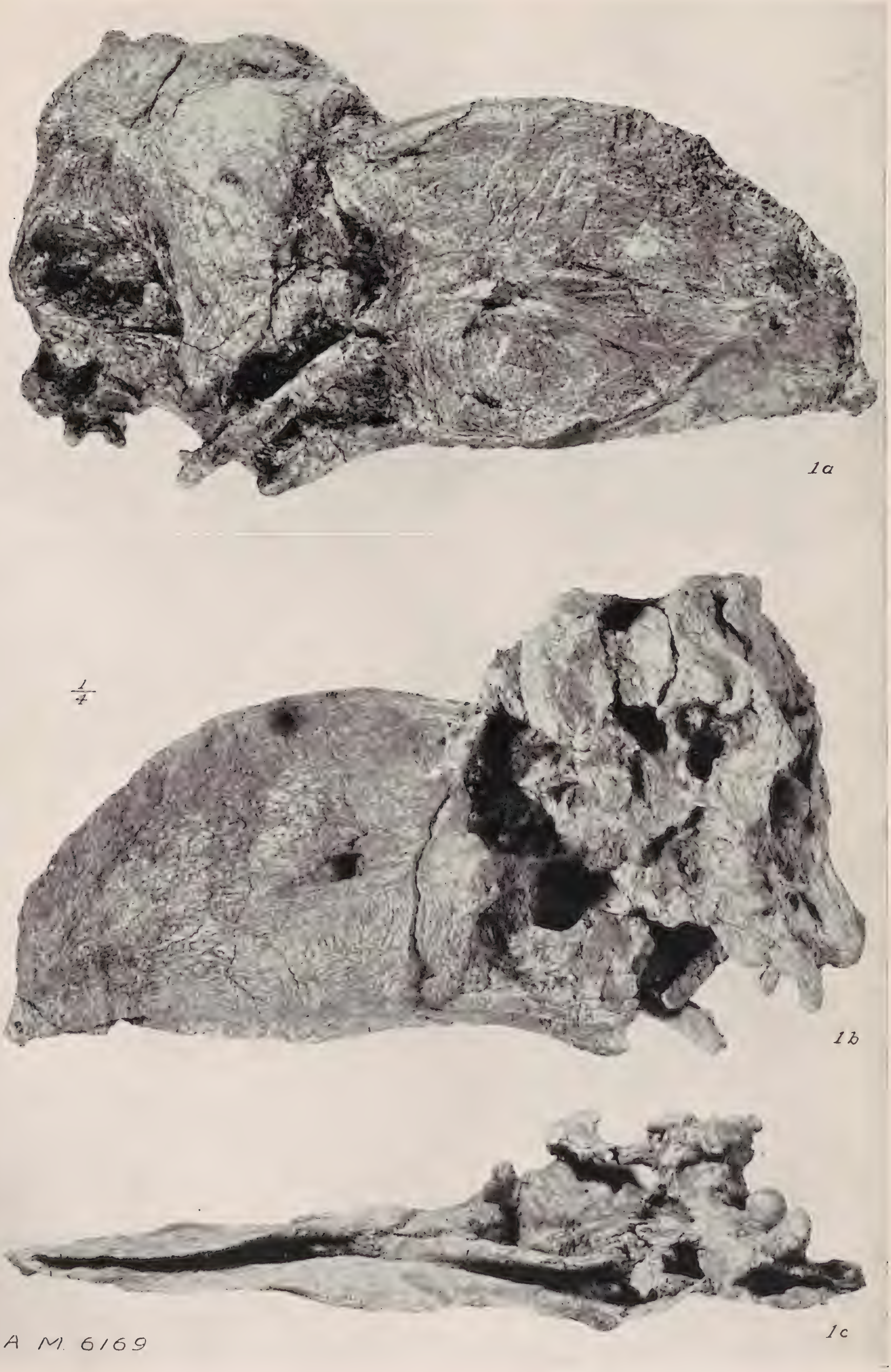
Plate XXIX. *Pelvis* and *sacrum*: Fig. 1a, ventral view. Fig. 1b, view of left side.

PLATE XXX. *Pelvis* and *sacrum*: Fig. 1a, dorsal view. Fig. 1b, view of right side.

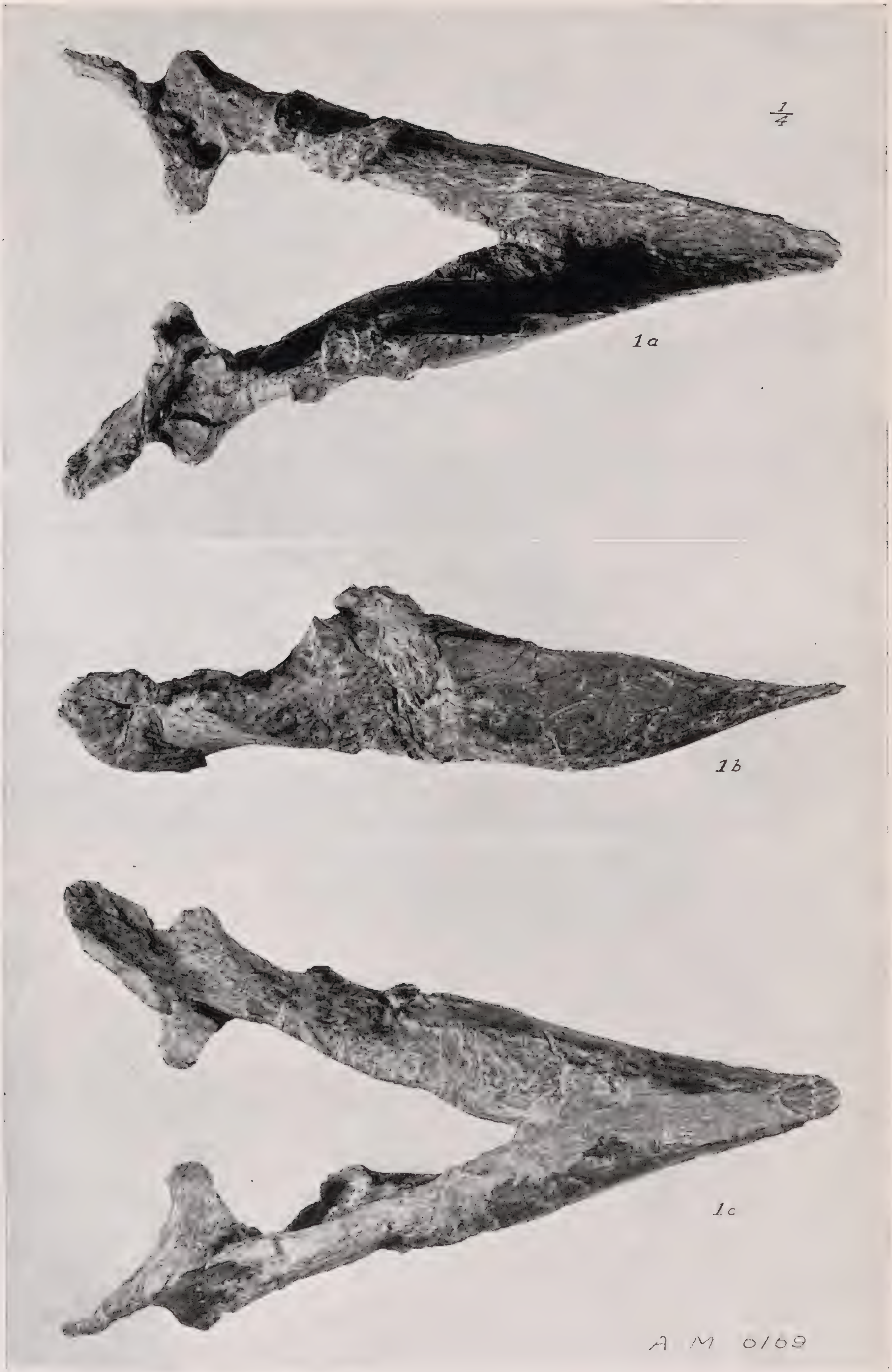
PLATE XXXI. Fig. 1. Right *scapulo-coracoid*, outer view. Fig. 2. *Humerus* of ? right side. Fig. 3. *?Radius*. Fig. 4. Front view of left *femur*. Fig. 5. Hind view of right *femur*.

PLATE XXXII. Fig. 1. Front view of right *tibia*. Fig. 2. Outer view of right *fibula*. Fig. 3. Front view of *pes*.

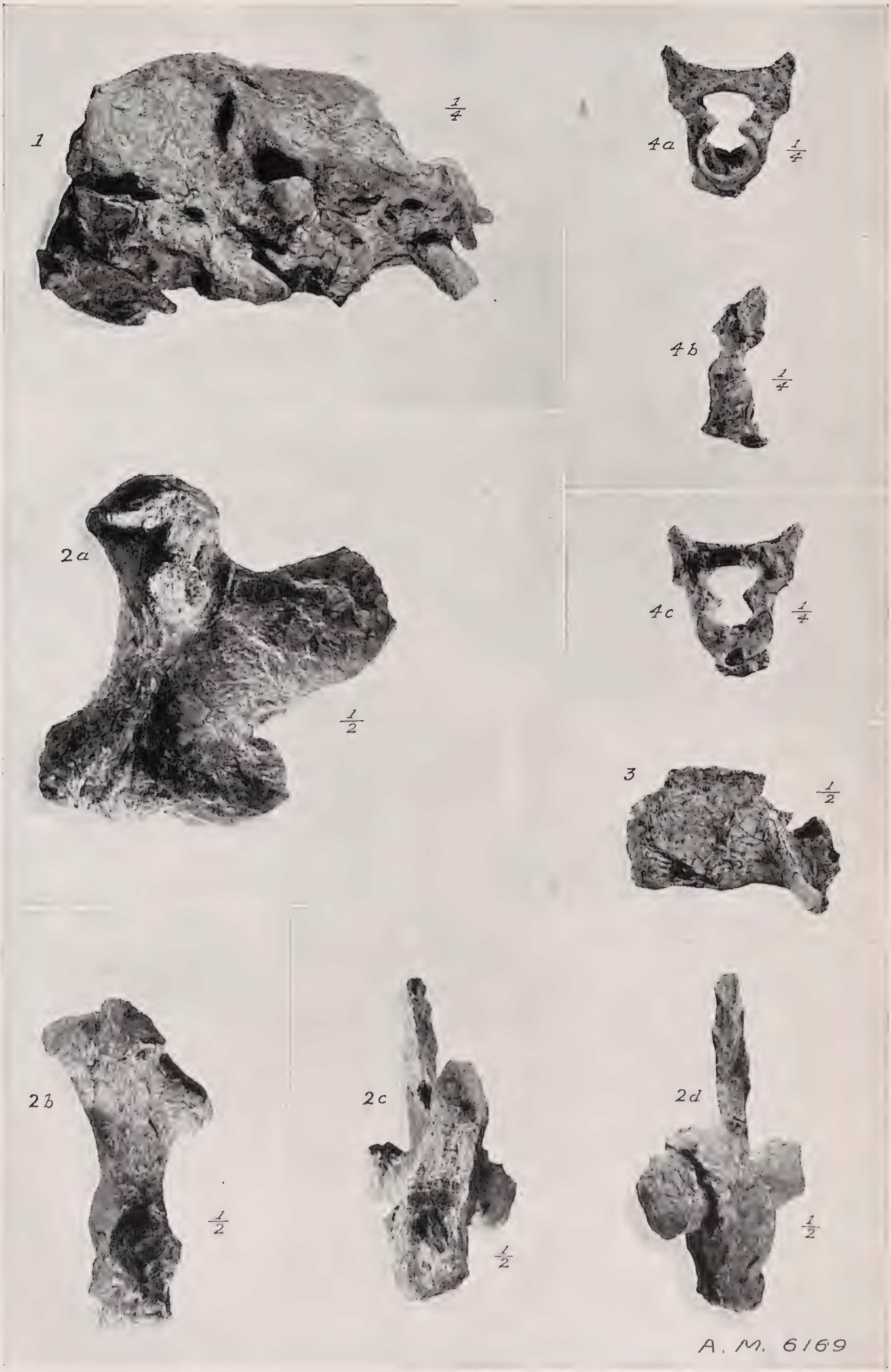
PLATE XXXIII. Restoration of *Diatryma steini*, one twenty-fifth natural size. In this restoration the cassowary has been used as a guide for the external characters, as it affords the nearest parallel among living birds in general proportions and adaptive specializations of the skeleton. Except as to size, proportions, and the characters of head and feet, the restoration is of course, conjectural.



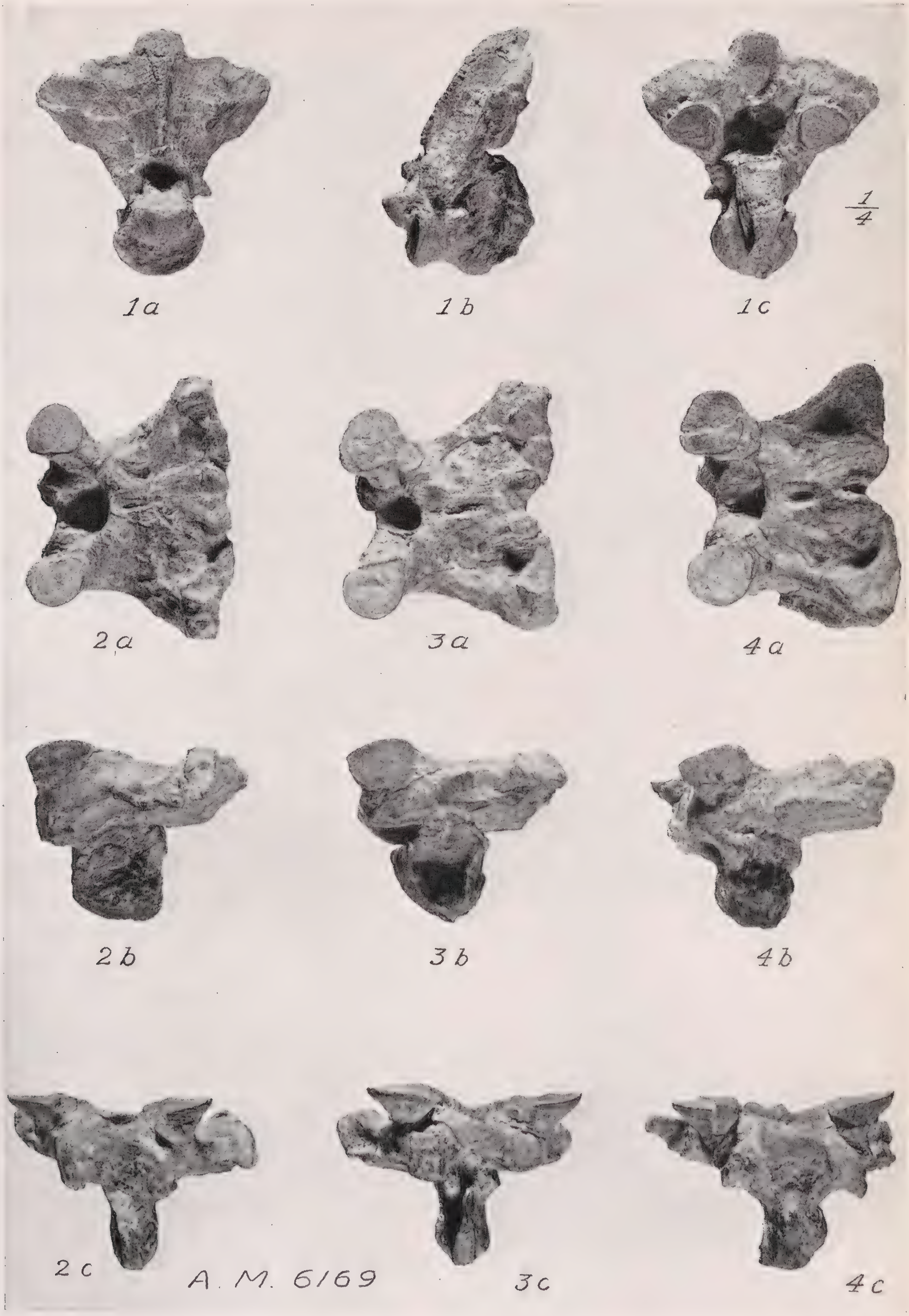
DIATRYMA STEINI.
Skull.



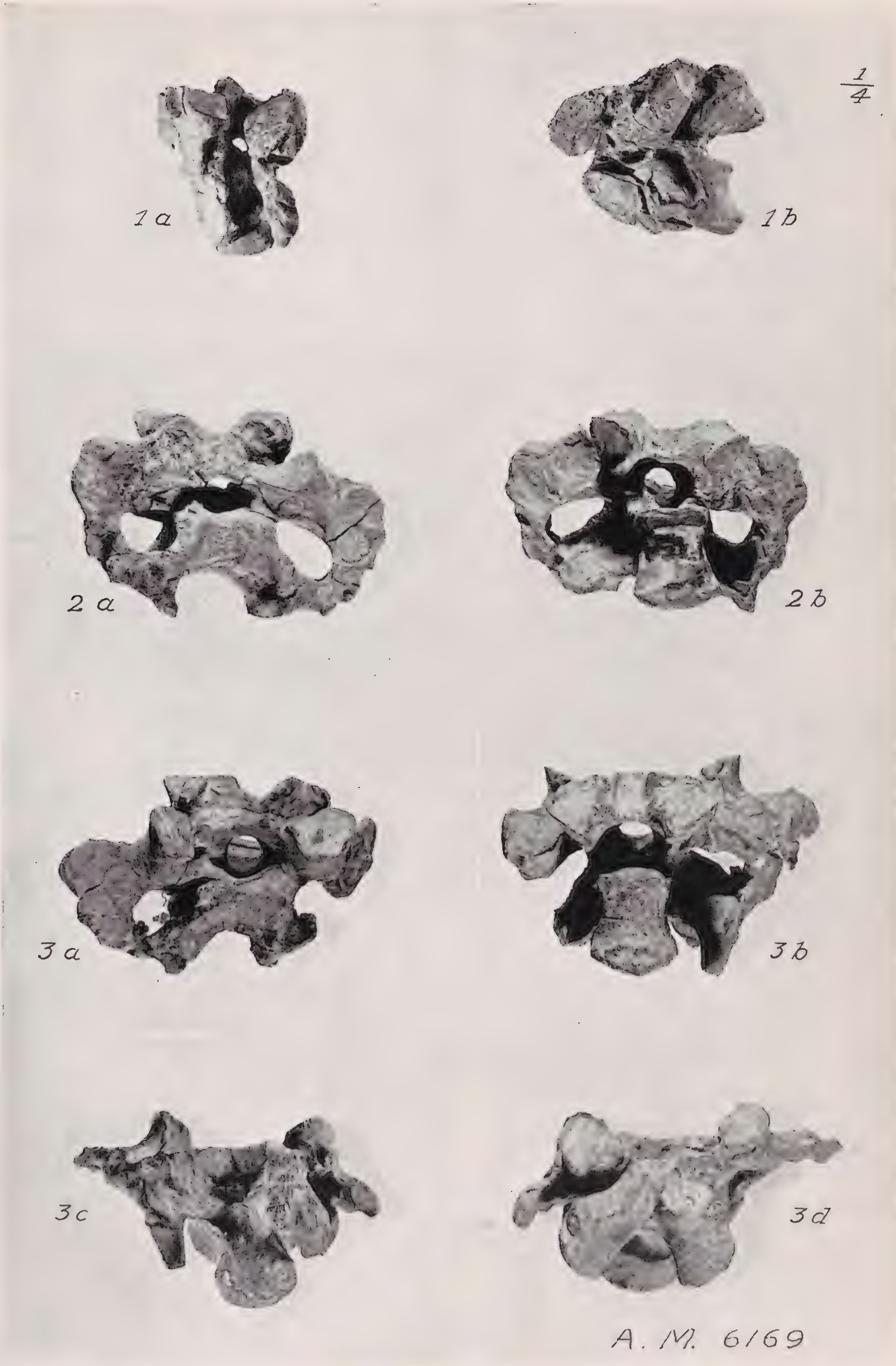
Diatryma steini.
Mandible.



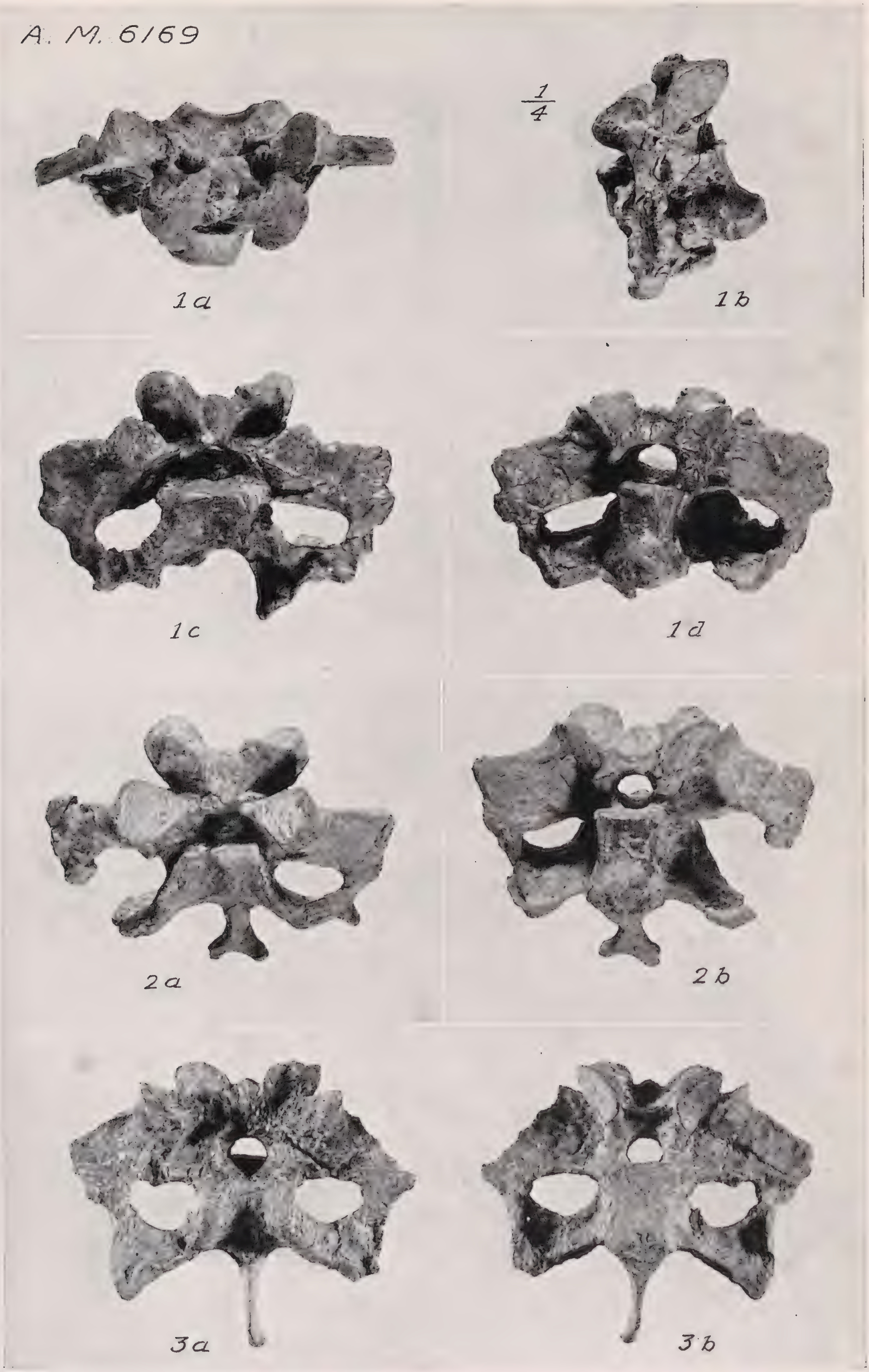
DIATRYMA STEINI.
Occiput, quadrate, (?) pterygoid and atlas.



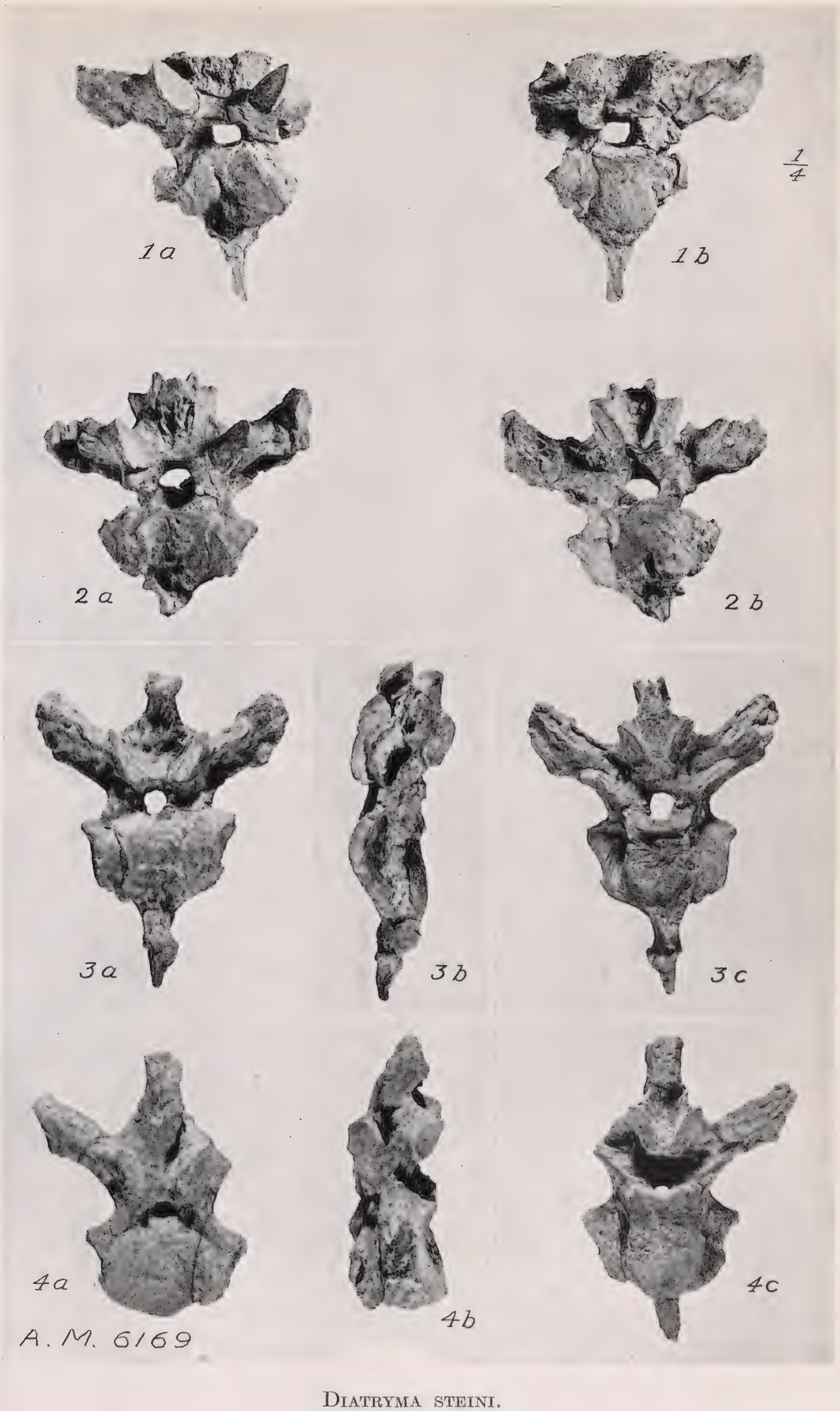
Diatryma steini.
Cervical vertebræ.



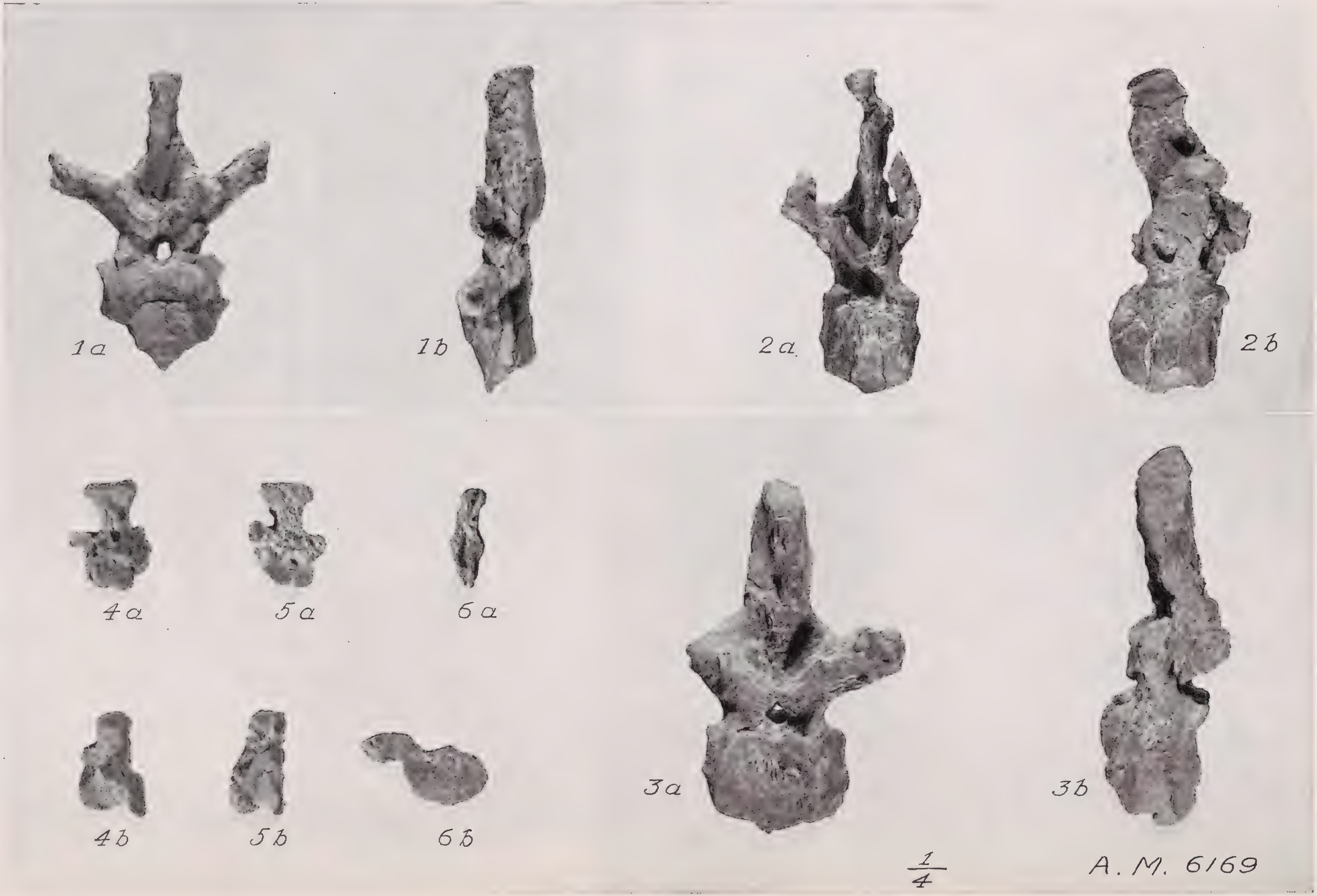
Diatryma steini.
Cervical vertebræ.



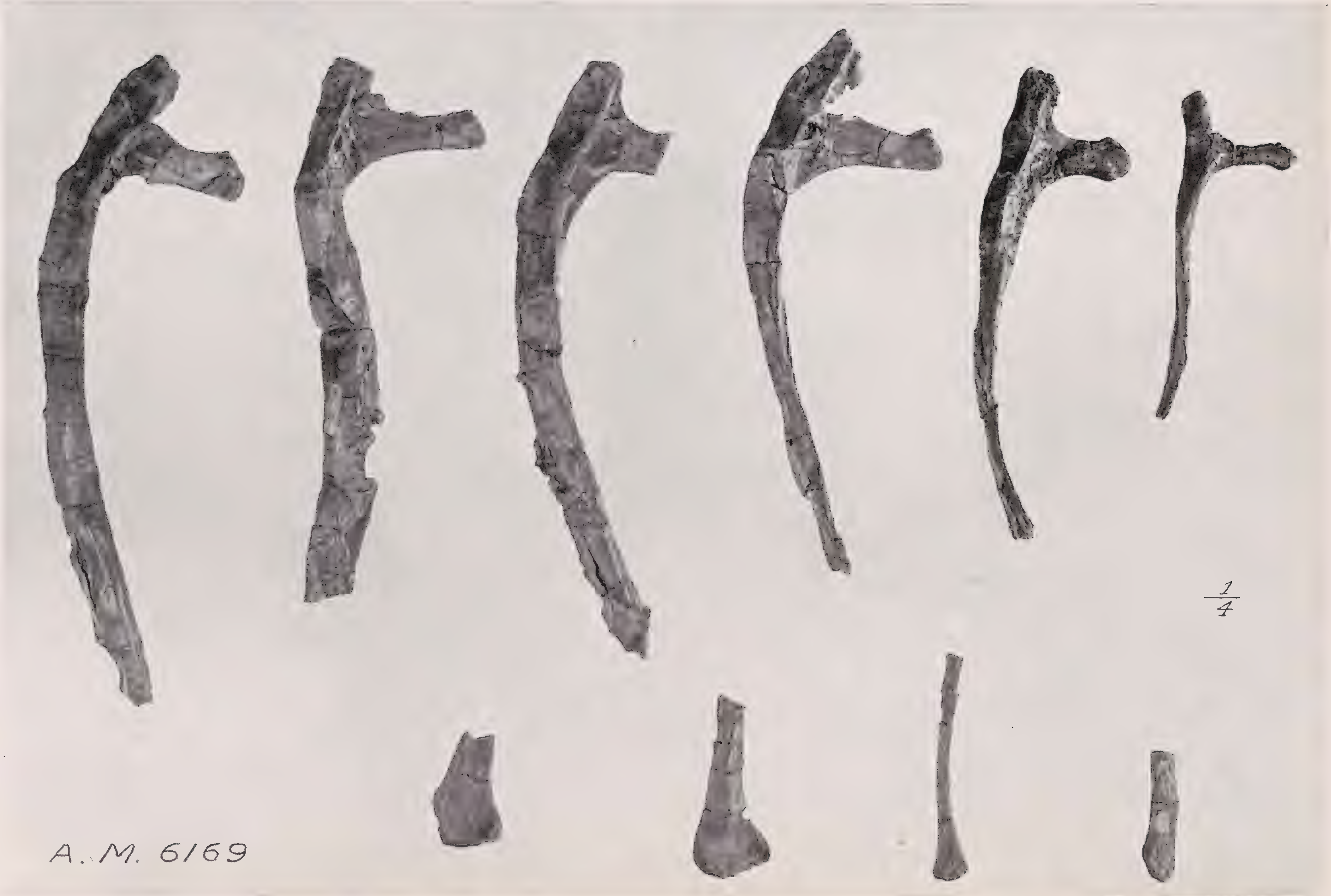
DIATRYMA STEINI.
Cervical vertebræ.



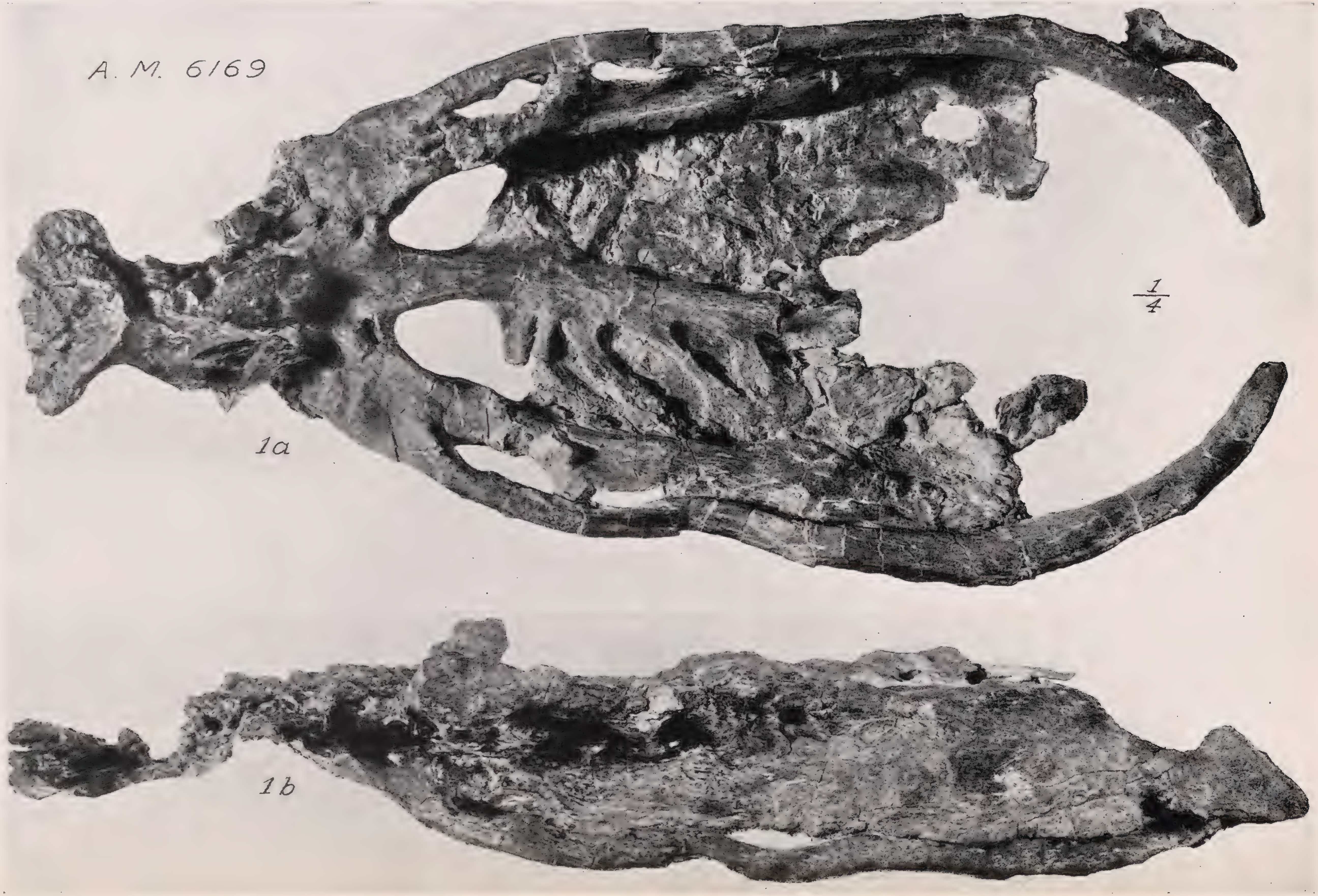
Diatryma steini.
Dorsal vertebræ.



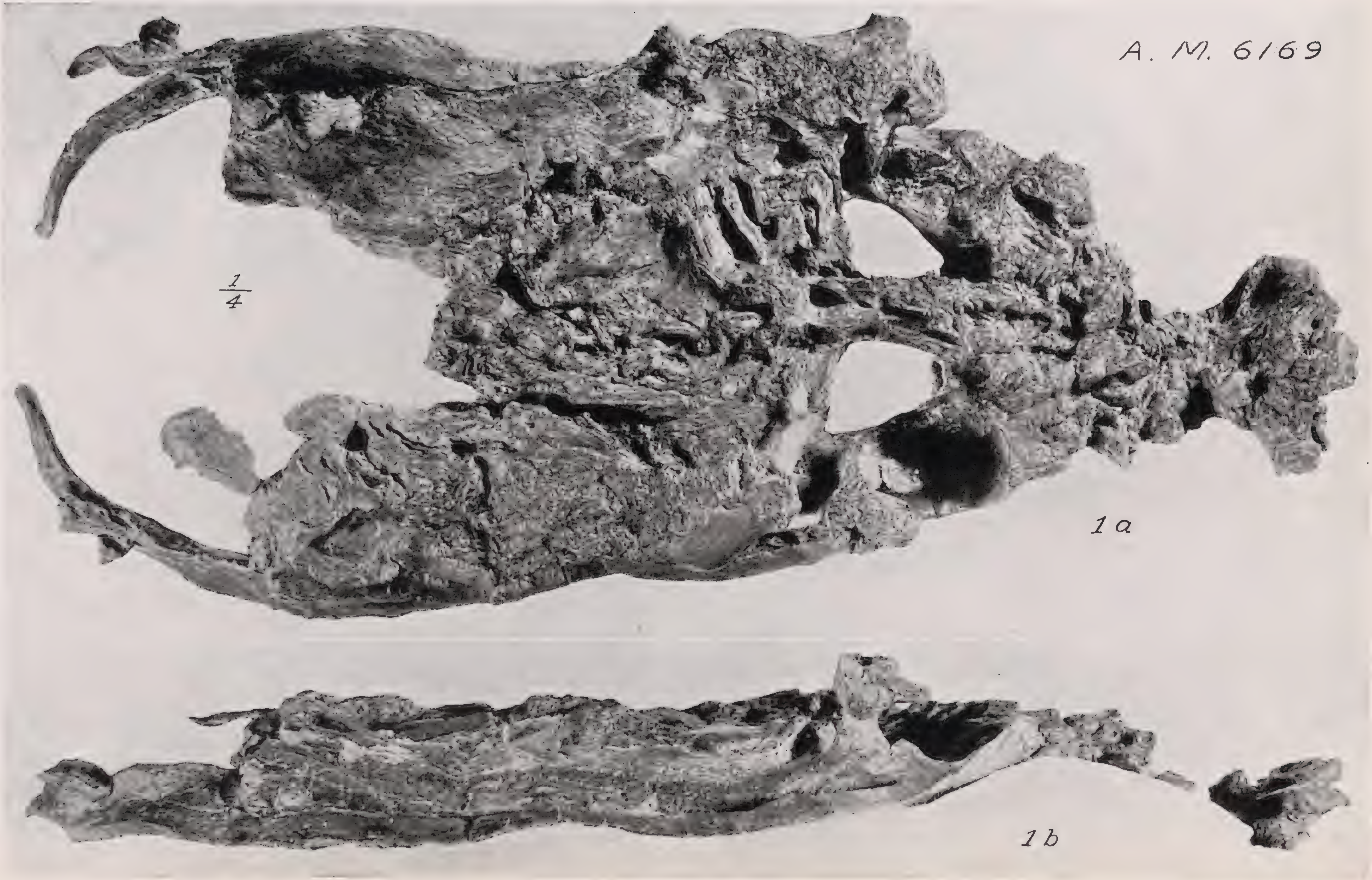
Diatryma steini.
Dorsal and caudal vertebræ.



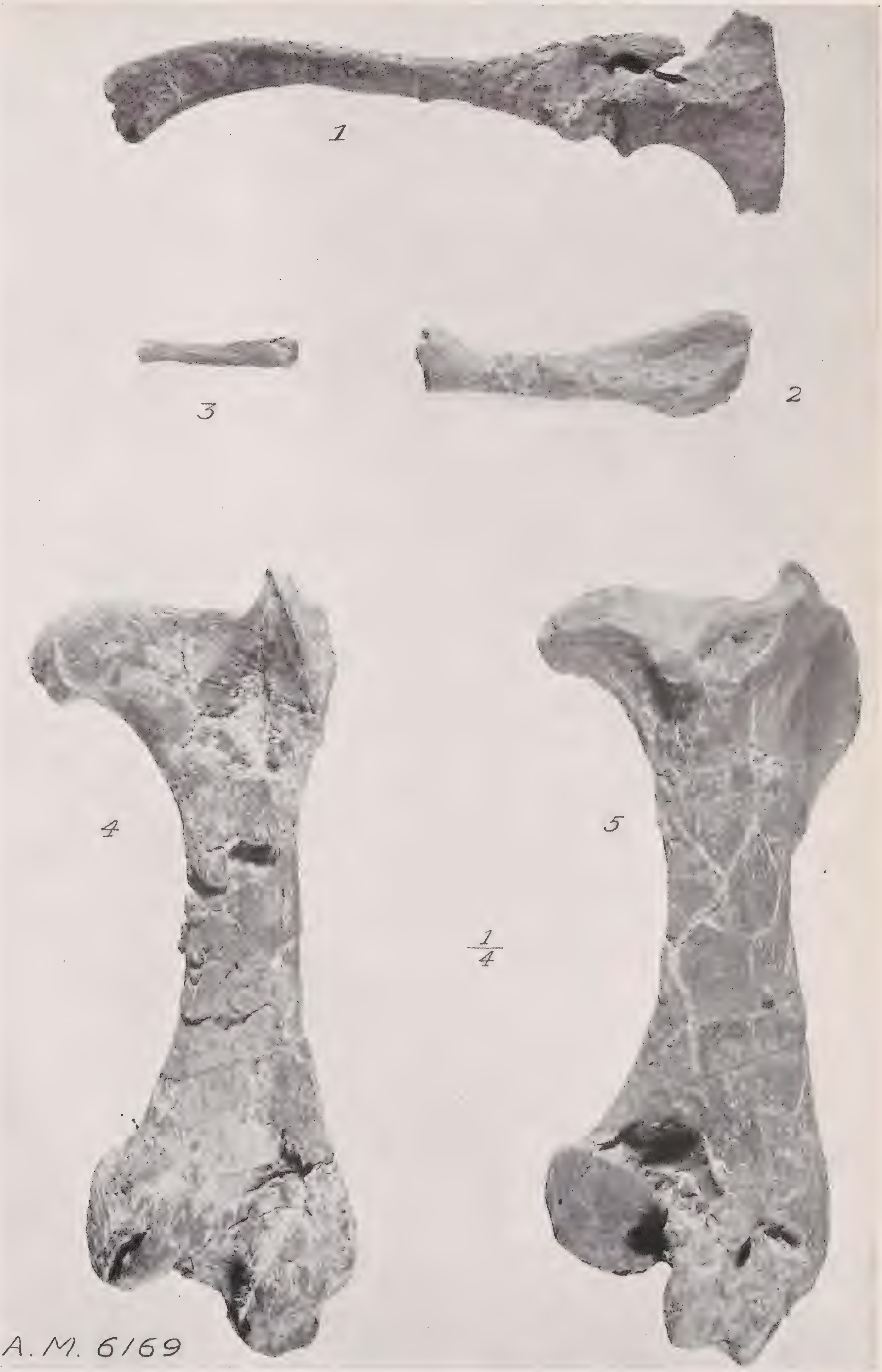
DIATRYMA STEINI.
Dorsal and sternal ribs.



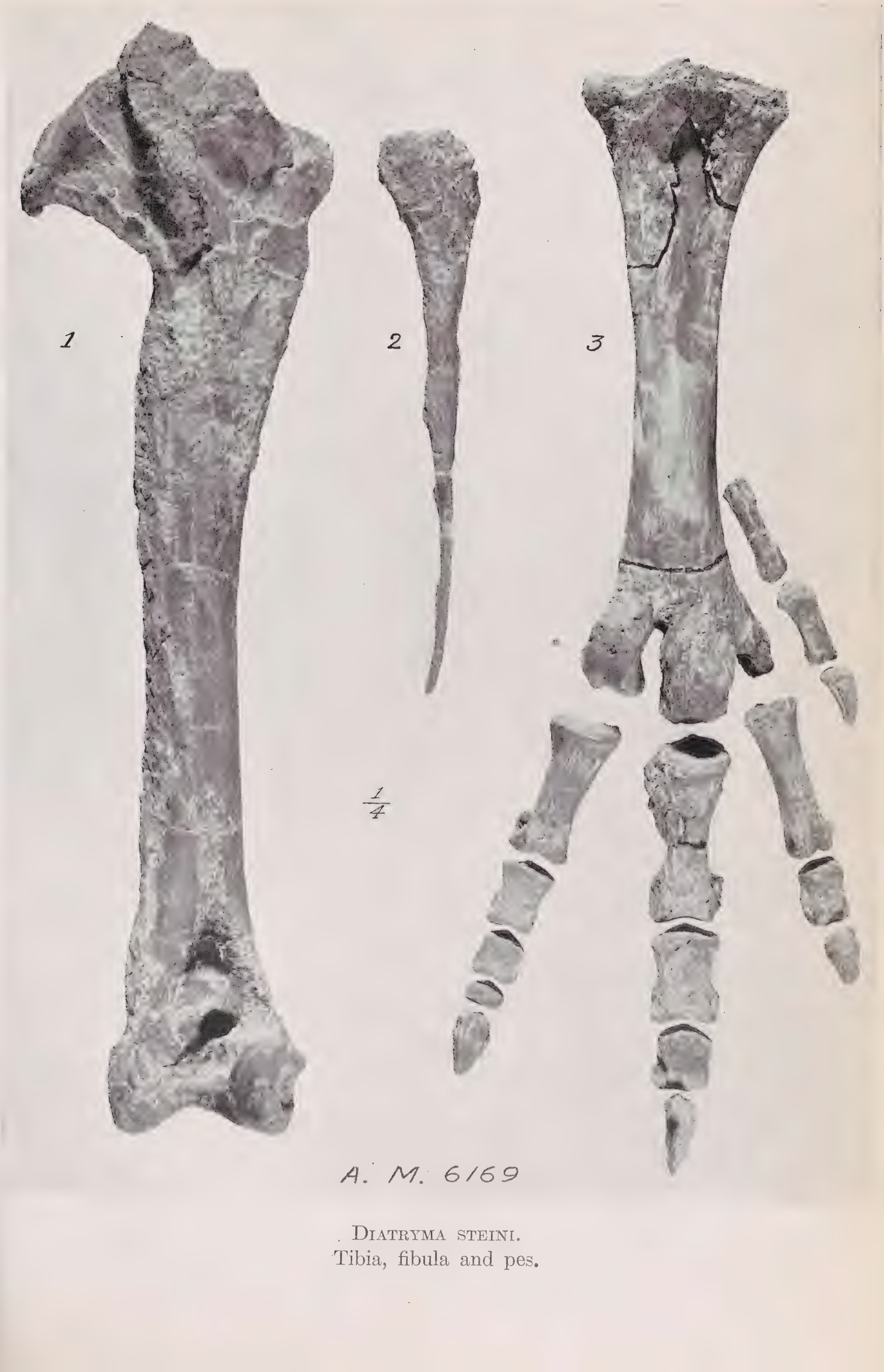
Diatryma steini.
Pelvis, ventral and left side views.



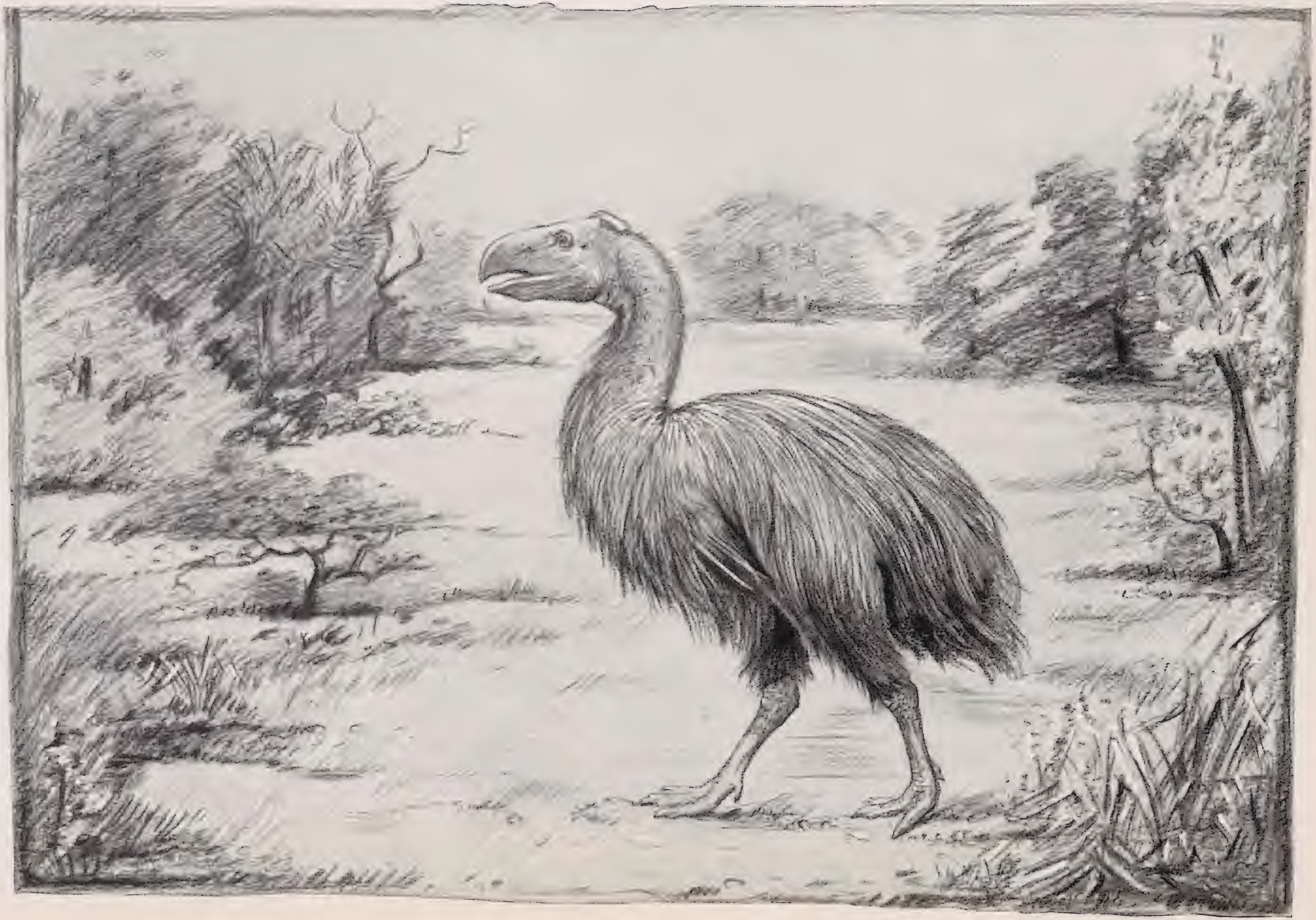
Diatryma steini.
Pelvis, dorsal and right side views.



DIATRYMA STEINI.
Shoulder girdle, humerus, (?) radius and femora.



Diatryma steini.
Tibia, fibula and pes.



RESTORATION OF DIATRYMA STEINI. $\times \frac{1}{25}$.

59.82(729.3)

Article XII.— DESCRIPTIONS OF NEW BIRDS FROM SANTO DOMINGO AND REMARKS ON OTHERS IN THE BREWSTER–SANFORD COLLECTION.

By Frank M. Chapman.

Mr. R. H. Beck, who for the past three and a half years has been collecting birds for Mr. Frederick F. Brewster and Dr. L. C. Sanford, chiefly on the coasts of southern South America, has recently passed several months in the island of Santo Domingo. He has worked on the coasts, and has also penetrated the little-known mountainous interior of the island. His collections from the last-named region contain several species which appear to be new to science, and also an excellent series of the forms of Andean White-throated Sparrow and White-winged Crossbill, discovered by Dr. W. L. Abbott in Santo Domingo in the fall of 1916, and heretofore known only from the specimens collected by him.

Mr. Beck's field-notes will not, unfortunately, be available until he returns to this country later in the year. Meanwhile, I append descriptions of the supposed new birds he secured, together with comments on the Sparrow and Crossbill discovered by Dr. Abbott.

Oreopeleia leucometopius sp. nov.

Char. sp.— Similar to *Oreopeleia caniceps* (Gund.), but forehead white rather than gray, crown, nape, and sides of head slate instead of gull-gray; back slightly darker, more bluish; wing-quills darker, with less russet or cinnamon; emargination of primaries nearer the tip; sides of breast more extensively metallic purple; ventral region more russet.

Type.— Collector's No. 7087, Brewster-Sanford Coll., ♂ ad., Jan. 27, 1917; Mt. Tina, Prov. Azua, R. H. Beck.

Range.— Known only from Mt. Tina, Túbano, and Las Canitas, Prov. Azua, Santo Domingo, W. I.

Description of Adult Male.— A broad white frontal band, slightly tinted with buffy (stronger in immature birds), reaches to above the eyes, its posterior margin is rounded, and the tips of the feathers are there grayish, but the band is clearly defined from, and in striking contrast to, the greenish slate of the crown, occiput, nape and sides of the head; hind head and nape more or less margined with metallic purple; head all around well defined from the metallic mulberry purple of the back and scapulars, which extends broadly to the sides of the breast, and, in some specimens, leaves only a narrow greenish slate pectoral strip; rump and upper tail-coverts ranging from acetin to dark dull bluish violet; tail-feathers uniform dark neutral gray; wings externally dark mouse-gray; inner webs of primaries and outer secondaries tawny russet, except at the tip; outer webs of five outer primaries more or less narrowly margined with tawny russet on their median portion; wing-coverts olivaceus, the inner, and to some extent, lesser coverts more or less strongly the color of the back; edge of the wing slaty; under wing-coverts cinnamon, tipped with slate; throat slaty, the white bases of the feathers more or less evident, especially on the chin; center of the breast darker and more or less washed with greenish; sides of the breast of the color of the back; sides slaty, the center of the abdomen grayish; ventral region, flanks and lower tail-coverts russet to hazel, paler on the vent, the flanks and lower tail-coverts glossed with purplish; "feet pink; bill red, tip pink; iris reddish" (R. H. B.).

Description of Adult Female.— Resembles the adult male in color.

Description of Young (*both sexes*).— Frontal band very narrow and not sharply defined from the brownish or slaty of the rest of the head; back merely washed with metallic purple; sides of the breast more or less rusty or cinnamon; violet-blue of rump less strong; wing-quills all more or less narrowly margined, and wing-coverts all tipped with cinnamon or russet; throat whiter, underparts more or less tipped with cinnamon or russet; abdominal region largely grayish brown; flanks and lower tail-coverts paler; "feet flesh-color; bill brownish; iris brownish" (R. H. B.).

Measurements.

	Wing	Tail	Tarsus	Culmen	Notch in second primary, from tip
Five Males	146–156	88–102	34	15	52–57 mm.
Five Females	144–150	85–91	32	14	51–54 mm.

Remarks.— While this new species and *Oreopeleia caniceps* of Cuba are obviously representative forms, the nature of the characters by which they are differentiated appear to be of specific value. The color differences are sufficiently pronounced to be more than differences of degree, while the unusual character supplied by the emargination of the second to fifth primaries (from without) is also evidence of prolonged segregation and specific distinctness. As the table of measurements shows, the second primary in *leucometopius* is notched at a point varying from 51 to 57 mm. from the tip of the feather; while the corresponding measurement in five specimens of *caniceps*, are 64 to 69 mm.

The commonest forest Ground Dove is by no means easy to collect, and the fact that Beck secured a large series of this species in a comparatively short time, is an indication of its abundance. This fact, in connection with the bird's occurrence in the Tropical Zone renders it surprising that it has heretofore escaped collectors.

Evidently the bird's range is restricted by its choice of haunts, and when we learn from the collector the nature of the country in which it was found, we shall doubtless have some light on the reason for its extreme localization.

I am indebted to Mr. Outram Bangs for the loan of five specimens of

Oreopelia caniceps, from the collection of the Museum of Comparative Zoölogy, collected by Barbour and Brooks in the Cienaga de Zapata, Cuba, in April, 1915.

Microsiphonorhis gen. nov.

Char. gen.— Most nearly related to *Siphonorhis* Scl. (monotypic; type *S. americana*) but nasal tubes shorter, 1.5 mm. in height (in skin) as compared with 3 mm. in *Siphonorhis;* bill disproportionately smaller, its outline from above more regularly triangular, less shield-shaped, the upper mandible not convex in outline, the ridge on its cutting edge less developed; rictal bristles apparently actually stronger; tail squarer, less graduate; tarsus and toes disproportionately longer.

Type and only known species, *Microsiphonorhis brewsteri.*

Microsiphonorhis brewsteri sp. nov.

Char. sp.— In general coloration resembling *Siphonorhis americana* but paler throughout, throat and pectoral band white instead of buffy; tips of rectrices broader and pure white sharply defined from the black subterminal area, which is much broader; abdominal region buffy white instead of ochraceous-buff, more narrowly and less regularly barred; tertials narrowly tipped with white.

Type.— Collector's No. 7199; Brewster-Sanford Collection; ♀ ad. ("sexual organs swelling." R. H. B.); Túbano, Prov. Azua, Santo Domingo, W. I., Feb. 10, 1917; R. H. Beck.

Range.— Known only from the type locality.

Description of type.— General color of upperparts brownish gray; crown finely vermiculated with white and brownish, the lateral feathers with narrow black shaft-streaks, the central ones more broadly striped and margined with ochraceous-tawny; antorbital region bright ochraceous-tawny or rusty, barred with black, margined above by a narrow, partly concealed, light buff loral streak, which extends backward above the eye where the slightly exposed black bases of the feathers break its continuity; auriculars cinnamon, vermiculated with black; nuchal band ochraceous-tawny streaked with black; scapulars velvety black, margined externally by light buff and rich ochraceous-buff, internal margins chiefly vermiculated with rusty, grayish and brownish; back and upper tail-coverts brownish gray vermiculated with buff, the interscapulars and upper tail-coverts with broad median, elongate black spots; exposed middle tail-feathers of the general color of the back, with five or six black bars or quadrate spots 7 or 8 mm. in width, and confined to the shaft portion of the feathers, the tips narrowly white; outer rectrices barred with black and ochraceous-buff, the latter areas mottled with blackish; a subterminal band black 10 to 12 mm. in width on the outer feathers, with slight traces of rusty; terminal band pure white, 5 mm. wide and sharply defined from the subterminal area; wing-quills fuscous, the outer webs of the primaries sharply barred with light ochraceous-buff, the inner webs with spots and incomplete light ochraceous-tawny bars; both webs of secondaries with broken ochraceous-buff bars; tertials vermiculated like the back and with narrow black shaft-streaks and terminal whitish spots; primary coverts fuscous, the outer web barred and margined with ochraceous-buff; remaining wing-coverts vermiculated with rusty with broad black shaft-streaks and rounded terminal buffy white spots; under wing-coverts ochraceous-buff, the edge of the wing narrowly and unevenly barred with black; chin and malar region ochraceous-buff, barred with black; a distinct white throat-band; pectoral region barred and vermiculated with black and ochraceous-buff, the feathers with large white terminal spots 5 to 7 mm. in width, which form a band across the lower breast; abdominal region and under tail-coverts buffy white narrowly and inconspicuously barred with black; tarsi brownish, toes black (in skin), "iris brown; bill blackish" (R. H. B.).

Comparative Measurements.

		Wing	Tail	Tarsus	Middle Toe	Hind Toe	Culmen	Width of Bill at Nostril
Microsiphonorhis brewsteri	♀	119.5	94.5	23.5	20	6	8.5	7.5 mm.
Siphonorhis americana	♀	135	125	23[1]	20[1]	—	12.5	12 mm.

Remarks. — This exceedingly interesting addition to the known West Indian avifauna apparently represents the Jamaican genus *Siphonorhis* in Santo Domingo. In length of tarsus, as well as in general color pattern of the body plumage, both birds resemble *Nyctidromus*, of the mainland from Texas to Argentina, of which, indeed, they may be insular off-shoots. The unusual length of tarsus indicates that they share the terrestrial habits of *Nyctidromus*. *Siphonorhis* is now believed to be extinct, and the fact that *Microsiphonorhis*, although an inhabitant of the Tropical Zone of Santo Domingo, has not been taken before, indicates its extreme rarity.

It affords me unusual pleasure to name this fine species, known only from the type, in honor of Mr. Frederick F. Brewster, whose generous support of the Beck Expedition to littoral South America during the past three and a half years, has resulted in the formation of a collection which, in its field, is unapproached.

Microligea montana sp. nov.

Char. sp.— Similar to *Microligea palustris* Cory but supraloral stripe, outer webs of second to fifth primaries (from without), and ends of three to four outer tail-feathers white; tail gray; underparts whiter; bill stouter.

Type.— Collector's No. 6978, Brewster-Sanford Collection, ♂ ad. ("sexual organs small" R. H. B.), Mt. Tina, Prov. Azua, Santo Domingo, W. I., Jan. 15, 1917; R. H. Beck.

Range.— Known only from Mt. Tina and Mt. Rucilla, Prov. of Azua, Santo Domingo.

Description of Male.— Crown, cheeks, nape, and foreback slate-gray; lores dusky, supraloral streak and spot on eyelid below, and sometimes above the eye, white; back olive-green; upper tail-coverts and exposed portions of central tail-feathers slate-gray; inner webs of tail-feathers black; the three or four outer feathers with white tips averaging 15 mm. wide on the outer feather and decreasing in width on the succeeding feathers; outer vane of outer feather white for its terminal half; wing-quills black, the outer and inner primaries with black outer as well as inner vanes; the second to fourth (from without) with the outer vane white basally and extending as a narrow but distinct white margin nearly to the tip of the second to fourth primaries, appearing also subapically on the fifth primary; secondaries strongly margined externally with the color of the back, which is in sharp contrast to the black of the inner primaries; alula gray; primary coverts black, remaining coverts externally, the color of the back; under wing-coverts white; underparts white, grayish on the sides and flanks; "feet grayish; bill black, bluish below; iris brown" (R. H. B.).

---

[1] Male, *ex.* Ridgway, Birds N. and M. America.

Description of Female.— Indistinguishable in color from the male.

Measurements.

	Wing	Tail	Tarsus	Culmen
Five males	67.5–69	68–70	19–20	13.5–14.5 mm.
Five females	66–69	63.5–69.5	20–22	13–14 mm.

Remarks.— Of this second known species of its genus, Mr. Beck secured a large series on Mt. Tina and Mt. Rucilla, but his labels unfortunately do not give the altitudes at which the specimens were taken. Its abundance, in connection with the fact that it was not found in the lowlands, apparently indicates that it is confined to the upper zone of Santo Domingan life; and for this reason it has heretofore escaped collectors.

The collecting of a large series of *Microligea palustris* at the same localities in which *M. montana* was found, shows that these two species are not representative of one another.

Loxia megaplaga Riley.

Loxia megaplaga Riley, Smiths. Misc. Coll., 66, No. 15, Dec. 1, 1916, p. 1 (El Rio, 4000 ft., Santo Domingo).

Beck secured thirty-one specimens of this species, heretofore known only from the type and a topotype, on Mt. Rucilla and Mt. Pelone (altitude not stated). Fifteen of these specimens are in streaked, immature plumage, and one of these, a female taken on Mt. Rucilla, March 5, has the tail only partly grown and is but a few days from the nest. The habit of early nesting evidently, therefore, persists in spite of the subtropical environment which this near relative of a boreal species now occupies.

Lacking a series of the European White-winged Crossbill (*Loxia bifasciata*), to which Mr. Riley (*l. c.*) compares this species, I am unable to add anything to his remarks on their relationships.

Dr. Abbott's discovery that a race of the White-winged Crossbill inhabits the pine forests of the higher mountains of Santo Domingo, is one of the ornithological sensations of recent years.

If the bird were a Red Crossbill, its presence, even in a West Indian island, would not be so surprising. This latter species nests as far south as the Alleghanies of northern Georgia, and its accidental occurrence in the Bermudas proves its ability to reach an island well removed from the nearest mainland.

The White-winged Crossbill is not known to nest south of northern New York, and, even in winter, it has not been recorded from south of Virginia. Its fortuitous occurrence in the West Indies is, therefore, not now to be expected. Nor does it seem probable that under existing climatic conditions, a bird of the Canadian Zone would thrive in the tropics, even at an altitude of 4000 feet, if introduced there.

If this be true, it follows that *Loxia* has adapted itself to life in the Subtropical Zone through, not a sudden, but a gradual climatic change. Such a change we know to have accompanied the wane of the last Glacial Period. Perhaps, therefore, we are warranted in assuming that the climatic conditions which brought the Musk Ox to Kentucky, the Walrus to the vicinity of Charleston, South Carolina, and the Great Auk as far south as Ormond, Florida, are also responsible for the original occurrence of the White-winged Crossbill in Santo Domingo.

The pines which had preceded it, and which may also be considered as boreal invaders forced southward by the Ice Age, offered the food supply the bird's habits require, and in its insular home it has been stranded, after the causes to which its presence is due have disappeared.

It is not implied that the existence of *Loxia* in the greater Antilles indicates a land connection between these islands and the southeastern United States. We have seen that the Red Crossbill is of recent occurrence in Bermuda, and it is therefore well within the bounds of probability to believe that during the time when the Glacial Period forced the White-winged Crossbill far below its present range in North America, it might have occurred fortuitously in Santo Domingo.

The case is, in a measure, paralleled by that of the Andean Horned Lark (*Otocoris alpestris peregrina*). Here we have a species of unquestionable boreal origin confined to the Savanna of Bogotá, in the Temperate Zone of the Colombian Andes. Its nearest relative is found in Mexico. It is not conceivable that the pioneer ancestors of the Colombian race can have crossed the wide area lying between that country and Colombia, and, as with the Santo Domingan Crossbill, we are forced to conclude that the original introduction took place when different climatic conditions prevailed in the areas concerned.

The fact that *Loxia megaplaga* is more nearly related to the European than to the American White-winged Crossbill, does not, of course, imply that it has descended directly from that species. Its characters of comparatively large bill and short wings are shown by many island-inhabiting races, and they doubtless indicate parallelism in development rather than direct descent from the physically nearest form.

Brachyspiza capensis antillarum *Riley.*

Brachyspiza antillarum Riley, Smiths. Misc. Coll., 56, No. 15, Dec. 1, 1916, p. 2 (Constanza, 5000 ft., Santo Domingo).

Mr. Beck secured thirty-eight specimens of this recently described form on Mt. Tina, Mt. Rucilla and at Las Canitas (altitude not stated).

This excellent series, in comparison with a very large number of specimens of *Brachyspiza capensis peruviana* from Colombia and Costa Rica, shows that while *antillarum* is a strongly marked insular race, the differences between it and the mainland bird are practically bridged by individual variation. It should, therefore, evidently stand as a subspecies of *Brachyspiza capensis,* its relationships to the ancestral type being more exactly expressed by a trinomial than by a binomial.

It is interesting to observe that the gradual increase in the amount of black on the throat, which accompanies the extension of the range of this species from the south northward, reaches its maximum development in the Santo Domingan race.

In nearly all the Brewster-Sanford specimens this band is complete, a condition rarely shown in mainland examples. It is most closely approached by specimens in the American Museum from Costa Rica and Chiriqui, and this fact gives support to the obvious assumption that the Santo Domingan bird was derived from Central American stock. The tail in the Santo Domingan specimens is, however, longer than in Central American specimens and equals in length the tail of Peruvian birds.

The occurrence of this species in Santo Domingo raises several interesting questions. It is obviously restricted to the mountains where it occupies the first life zone above the Tropical Zone. Dr. Abbott's specimens were taken at an altitude of 4000 and 5000 feet, and the fact that a bird which is so common and so easily observed was not discovered prior to his visit, argues that it is not found in the lowlands. In Central America, as well as in Colombia, *Brachyspiza* is also characteristic of the second or Subtropical Zone, below which it rarely descends.

The presence of this genus in Santo Domingo may be explained in one of two ways. It may have entered the island during a past land connection with Central America, or it may be of fortuitous occurrence. If the present climatic conditions existed during the period of supposed continental connection, we may assume that the land forming this connection reached the altitude of the zone below which, both in Santo Domingo and Central America, *Brachyspiza* is not found. On the other hand, the apparent absence of *Brachyspiza* from Jamaica and Cuba argues against its reaching the West Indies over a land bridge. In short, the case presents one of those fascinating problems in distribution which stimulate speculation even if they defy solution.

59.9(801)

Article XIII.— A NEW RABBIT AND A NEW BAT FROM NEOTROPICAL REGIONS.

H. E. Anthony.

Plate XXXIV.

Among the mammals collected by the author in Panama in 1914 and reported on by him in 1916 [1] a *Sylvilagus* taken at Old Panama was commented on as worthy perhaps of separation from *Sylvilagus gabbi gabbi* which ranges throughout the Canal Zone, but for lack of abundant comparative material it was left with *g. gabbi.* Later the question was reopened and Mr. E. A. Goldman, who has ready for press an extended report on the mammals of Panama agrees with me that the *Sylvilagus* from the savanna region of Panama deserves a new name. The author wishes to acknowledge indebtedness to Mr. Goldman for the loan of comparative material from the more humid Canal Zone.

Sylvilagus gabbi consobrinus subsp. nov.

Type, No. 36793, ♀ ad., Old Panama, Panama, Feb. 21, 1914; collector, H. E. Anthony, Shiras Expedition.

Very similar to *S. gabbi gabbi* Allen but differing from it noticeably in lighter coloration.

Upperparts mixed warm buff and black, the black being on the tips of the hairs and giving the predominating tone to the pelage; sides lighter, cartridge buff grizzled with black; top of head russet, the hairs black at the base; nape not contrasting conspicuously with rest of upper surface, the short sparse hairs cinnamon rufous; cheeks like sides and with scarcely any black; superciliary stripe maize yellow; white patch at either side of nostrils and on lower lip and chin extending backward to even with ear; ears resembling dorsal region and without any conspicuous black areas; upper surfaces of fore and hind limbs tawny to russet; underparts white; throat like sides but lacking black tips to any of the hairs.

Total length, 373 mm.; tail, 28 mm.; hind foot, 79 mm.

Skull not essentially differing from that of *gabbi gabbi* but slightly narrower interorbitally than a skull of true *gabbi* from Gatun. Compared with a series of 9 skulls of *gabbi messorius* from the Darien the skull of *consobrinus* is noticeably smaller than the average of the series. Skull measurements: Total length, 67.8 mm.; zygomatic breadth, 33.9 mm.; interorbital breadth, 15 mm.; length of nasals, 27.5 mm.; palatal length, 26.5 mm., length of palatal bridge, 6.5 mm., maxillary toothrow, 13 mm.

The closest affinities of *consobrinus* are with *gabbi gabbi,* type locality Talamanca, Costa Rica. Mr. E. A. Goldman of the U. S. Biological Survey, found upon examination that *gabbi* from the humid, forested Canal Zone was indistinguishable from specimens from Costa Rica. Using one of Mr. Goldman's skins from Gatun as a basis the specimen from Old Panama may be regarded as a paler geographical race. The savanna belt of Panama in which the ruins of Old Panama are located is much drier and far more arid than the other portion of the isthmus. *Sylvilagus* from as far south as Corozal, Canal Zone, are the dark *gabbi* and the arid zone subspecies, *consobrinus,* apparently is not found outside of the narrow coastal strip. Specimens of *Sylvilagus* in the collection of the American Museum from Boqueron, Chiriqui, are intermediate in part between *consobrinus* and true *gabbi* and have been hitherto referred to the latter where it appears they had best remain. Compared with specimens of *gabbi messorius* from the mountains of eastern Panama *consobrinus* is decidedly paler since *messorius* is even darker than typical *gabbi.*

---

[1] H. E. Anthony, Bull. Amer. Mus. Nat. Hist., Vol. XXXV, Art. XX, p. 371, June 9, 1916.

Only one specimen, the type, was secured in the savanna belt of Panama.

In comparing a new stenodermine bat from Cuba with the available material of this group in the American Museum it was discovered that *Ardops haitiensis* Allen[1] is not an *Ardops* but a *Phyllops.* Mr. Gerrit S. Miller, Jr., of the United States National Museum, has kindly loaned the author six skulls of the genus *Ardops* among which is the type species *nichollsi* from Dominica. A careful comparison with this borrowed material shows that *haitiensis* is quite distinct from any species of *Ardops* but agrees well with *Phyllops falcatus* in all characters of generic rank. The two genera are sufficiently similar in most characters to make it very difficult, if not impossible, to place an unknown species of either without the aid of comparative material and this explains how *haitiensis* came to be considered as an *Ardops* in the past. Inasmuch as *Ardops* has not been taken in the Greater Antilles, barring the Haiti record, this transfer of *haitiensis* makes the range of *Ardops* as now known more definitely restricted. A new species of *Phyllops,* a form very similar in general characters to *haitiensis* was taken from a cave in Eastern Cuba in February of this year. Thus the number of species of *Phyllops* will be raised from one to three. The new form was found as a fossil and judging from the condition of the specimens evidently has not been frequenting this region since the more recent animal remains, bats of the present day, were deposited. Therefore, while it is quite possible that this bat may be discovered living on some part of the island I am led to believe that it is truly extinct, a fossil of an earlier period than the very recent and hereby propose as a name *Phyllops vetus.*

---

[1] *Ardops haitiensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist. 1908, p. 581.

Phyllops vetus sp. nov.

Type, No. 41001, Dept. of Mammals, from a cave at Daiquiri, Province of Oriente, Cuba, Feb. 1917; collector, H. E. Anthony. The type is a skull, without mandible, lacking the incisors, two premolars and a third molar and with a portion of the braincase broken.

Most like *Phyllops haitiensis* in general proportions and size of skull and also like *P. falcatus*, proportionally, but noticeably smaller. From both of these species *vetus* differs markedly in several important details.

Skull high and rounded, the view from above presenting most of the well known characters of *Artibeus*. Rostrum short, not expanded and nearly flat with no concavity; nares opening slightly upward. Zygomatic arches rounded in contour, flaring and of moderate width across jugals.

Palate short, horse-shoe-shaped and deeply cleft by the interpterygoid fossa, this notch reaching nearly to the anterior border of the first molar where it ends as a U: the sides of this emargination converge gradually as they penetrate the palate and are straight lines throughout their length. The pterygoid processes are prominent and sharply angular. A pair of deep pits nearly meeting in the midline are present in the basi-occipital region.

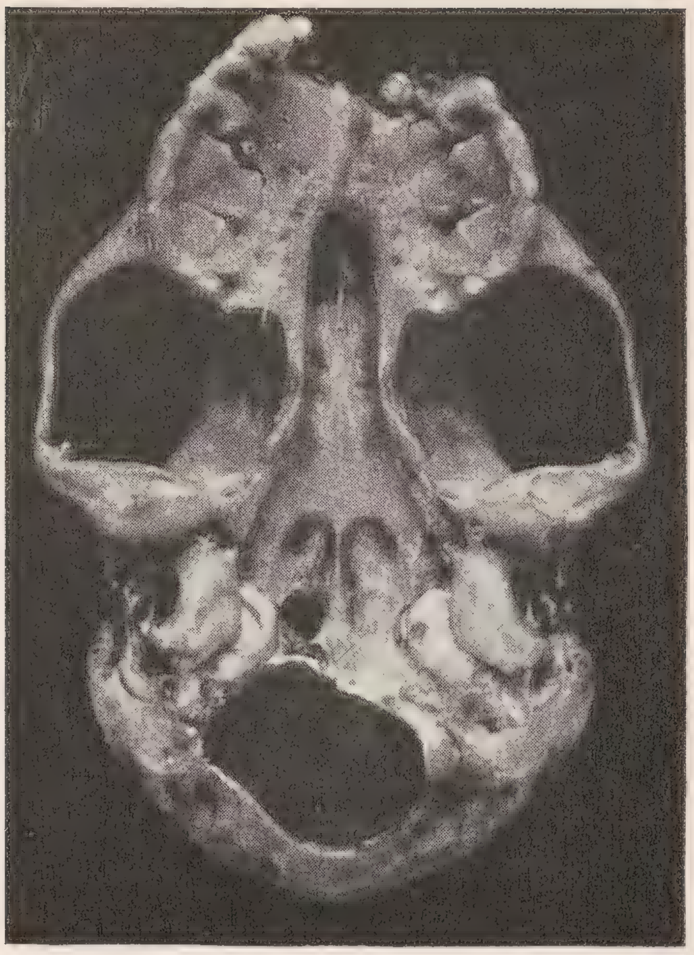
The dentition is that of the type species of the genus, *P. falcatus*. The teeth are smaller than in *falcatus* and the molars are proportionally wider, antero-posteriorly than in this species. The third molar, quite small, has the crown nearly circular in outline.

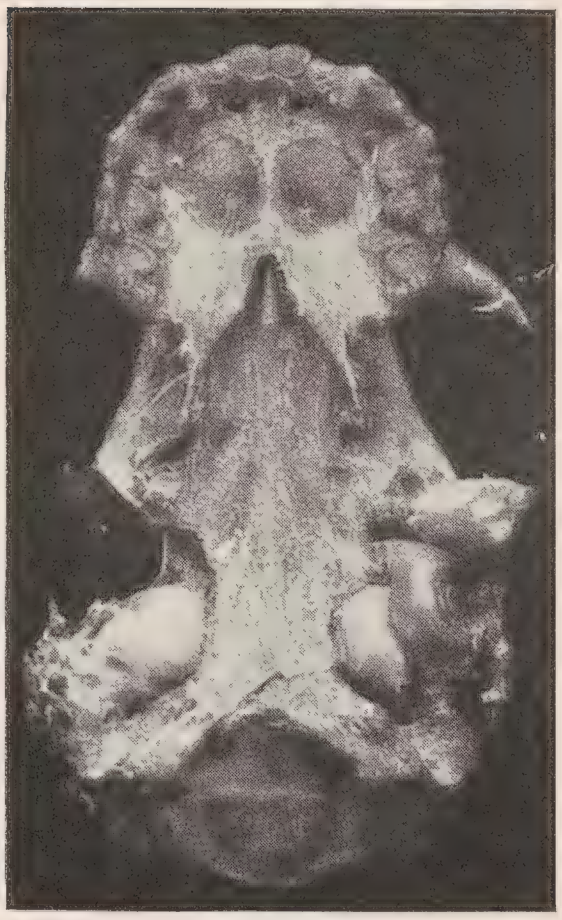
A mandible arbitrarily selected to go with the type presents no detailed differences except size to mark it off from *falcatus*. The full number of molars, three in this genus, is present on one side in the fossil.

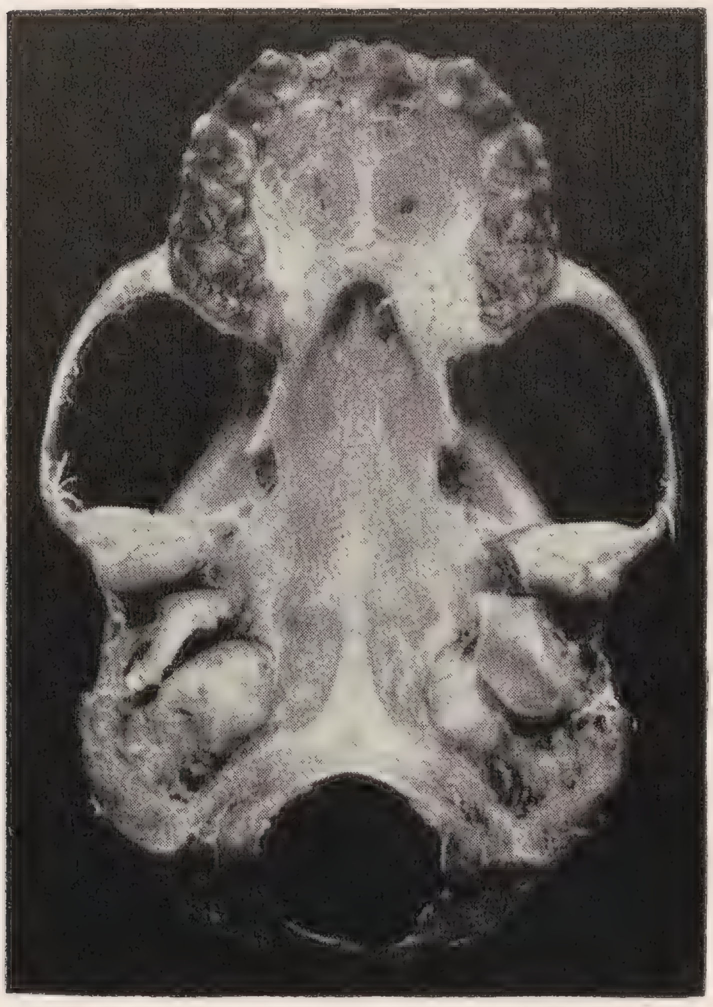
Measurements: Basal length, 15.8 mm. (of topotype, 15.5 mm.); greatest length of skull (topotype), 20.2 mm.; greatest breadth of braincase (topotype), 10.4 mm.; interorbital breadth, 5.4 mm. (topotype, 5.2 mm.); zygomatic width (topotype), 13 mm.; width of palate outside of m^2, 7.8 mm.; (topotype), 7.5 mm.; palate, postpalatal notch to posterior border incisive alveolus, 3.8 mm. (topotype, 3.6 mm.); width palate inside of m^2, 4.5 mm., (topotype, 5.35 mm.) width from tip to tip of pterygoid processes, 4, (topotype, 3.9 mm.); mandibular length, 10.9 mm.

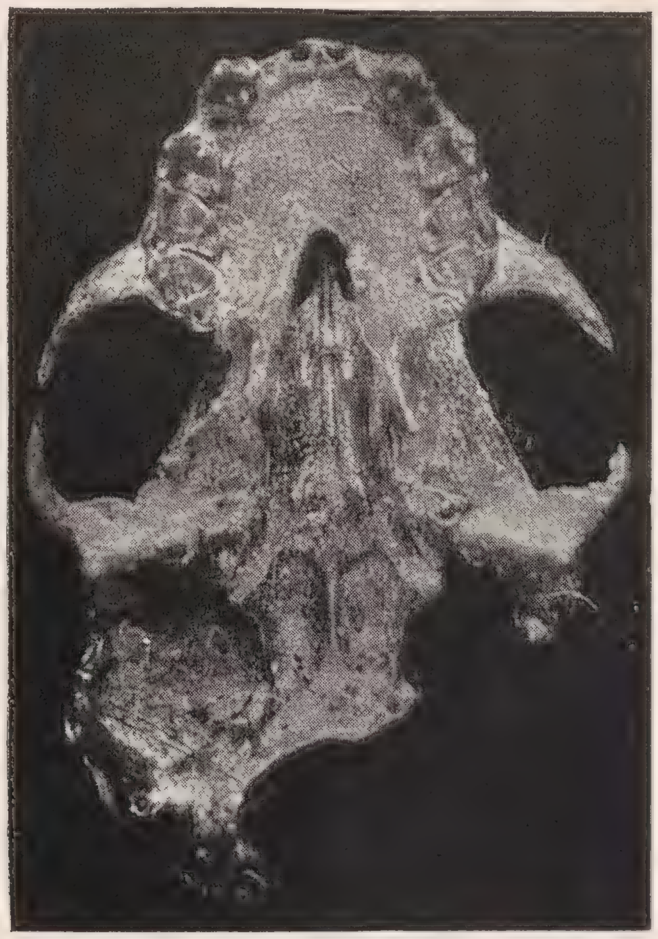
Vetus is sufficiently well characterized to be readily distinguished from either *falcatus* or *haitiensis* at a glance. From *falcatus*, the smaller size of the skull in general and the palate in particular, the more nearly parallel-sided palatal emargination, the presence of deep pits in the basioccipital region, and the cross section of m^3 circular instead of oval are clear cut distinguishing characters. *Haitiensis* and *vetus* are of approximately equal size and more nearly resemble one another than do *vetus* and *falcatus*. *Haitiensis*, however, does not have the prominent basi-occipital pits, the palatal emargination is V-shaped instead of U-shaped, and the sides of the emargination are not straight lines. Other minor differences exist but are not necessary to establish the identity of the new form.

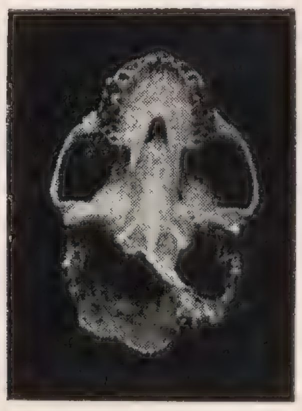
Material collected.—About 40 skulls, most of them quite fragmentary, and 5 mandibles of this new species were collected, the greater part coming from one cave although it was taken from another cave as well, both at Daiquiri.

1



2

3



4

5


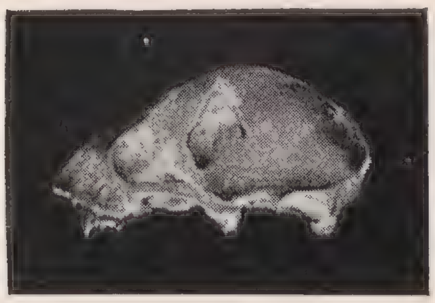

6

Fig. 1. *Ardops nichollsi.* $\frac{3}{1}$.
" 2. *Phyllops haitiensis.* $\frac{3}{1}$.
" 3. " *falcatus.* $\frac{3}{1}$.

Fig. 4. *Phyllops vetus,* type. $\frac{3}{1}$.
" 5, 6. " " topotype. $\frac{1}{1}$.

59.57.8 (729)

Article XIV.— NOTES ON WEST INDIAN SYNTOMIDÆ AND ARCTIIDÆ (Lepidoptera)[1].

By Wm. T. M. Forbes.

I.

The following records add to the distribution of the species as recorded in Hampson's Catalogue of the Lepidoptera Phalænæ:

Eunomia columbina (F.). Maricao, Porto Rico, Jan. 23, 1914. A single female disagrees markedly with Hampson's description and Hübner's figure of the male, and approaches *rubropunctata* Butl. Base of abdomen, largely red beneath, the terminal segments with paired subventral red spots of which the last is the largest. Dorsal white band on second segment, and red band on third segment broadly interrupted in the middle. Lateral red band continuous, as in *E. rubropunctata,* but narrower, and extending dorsad in long teeth on 4th and 5th segments. End of abdomen with a white dorsal spot. Border of fore wing only 1 mm. broad at vein 3, without any white lines or red scales above.

Nyridela chalciope (Hübner). Guantanamo, Cuba; Sanches, Santo Domingo, June 15–18; Kingston, Jamaica; Near Troy, Jamaica, May 15, 1913, at night. (See below.)

Cosmosoma auge (L.). North of Vinales, Cuba, Sept.

Æthria rubipectus Schaus. La Vega, Sanchez and San Lorenzo, Santo Domingo, May to July.

Napata chalybea (Hübner). "Honduras, Edwards." The locality is surprising, but it is so given in the original Edwards catalogue.

Lymire edwardsi (Grote), *Lymire candida* n. sp. and *Lymire senescens* n. sp. (See below.)

Empyreuma pugione (L.). Santo Domingo. I believe this specimen represents practically the typical form.

Empyreuma affinis Roth. Santiago, Cuba, Dec. 7; New Providence, Bahamas, Nov. 12; "Sierra Leone", doubtless in error, but the specimen seems to belong to this species.

Empyreuma affinis haytiensis Roth. Sanchez, Apr. 22, Sept. 16; San Lorenzo, May 27–29, June 24–26, Santo Domingo.

Empyreuma anassa n. n. (See below.)

---

[1] The specimens referred to in these notes are all in the Collection of the American Museum of Natural History.

Correbidia bicolor (H.-S.). North of Vinales, Cuba, Sept.

Opharus bimaculata (Dewitz). Montego Bay, Jamaica, May 5-13; Balaclava, Jamaica, April 24, at night.

Ecpantheria albicornis Grote. In series from Cuba, the male, as Grote's figure suggests, turns out to have broadly pectinate antennæ, and makes the species really subgenerically distinct.

II.

The genus *Utetheisa* has always been more or less a source of dispute, as the species seem to run to such a variety of forms in one place, while remaining constant in another. Under the conditions it seemed that structural characters, and especially the genitalia would throw some light on the matter; and a series of specimens were prepared of the various nominal American forms (lacking *U. galapagensis*) and of *Utetheisa pulchella* (L.) and *semara* Moore, from the Old World, for comparison. The two latter species are practically identical in markings. It turned out that while the Old World species had strikingly marked structural characters in every case, the Americans were identical within the range of individual variation. This would be evidence that there is only one, locally variable, American species. Another piece of evidence is that the species, as represented in the Museum, shows every imaginable intergrading form, with one exception; and that exception is between *ornatrix* var. *stretchii* and *venusta* (*speciosa*), apparently because the pink color of the hind wing is inherited in a Mendelian way. Another noticeable point is that the forms, while intergrading completely when viewed geographically, are nevertheless sharply marked as to each of several characters, and that material from a given station will show a limited number of forms, indicating with a good deal of probability that these characters are inherited in a Mendelian way; and the existence of nearly every possible combination of characters would show that they are independent, more or less completely, of each other. Thus the hind wing is either white (*ornatrix stretchii*) or pink (*venusta*, *bella*). The few exceptions come from Porto Rico. They are *stretchii* which in other characters also is a combination of typical *ornatrix* and *venusta*. It is not unlikely that they represent the heterozygous condition for this character. The black spotting and extent of ground color of the fore wing also show a sharp separation into two classes, independent of each other — as various Porto-Rican specimens show, as well as the Jamaican form with cream-white fore wings — and also independent of the color of the hind wings. The color of the fore wing and the black marking of the hind wing (accompanied by sexual dimorphism in that the extreme dark forms occur only or mainly in the female) show more complex conditions; yet even here certain phases (supposed to characterize typical *bella, venusta,* and the two sexes of *ornatrix* in the case of the hind wing) are dominant. *Ornatrix* is as old a name as any, and has the advantage over *bella* of page priority and of more correct classification, so it will stand as the specific name for the whole complex. The other names would be applied somewhat differently, according to whether the locality (races) or the type of markings were taken as a criterion. Perhaps it would be best to use them as applying only to specimens of the typical forms from the type regions, namely:

U. ornatrix ornatrix (L.). Ranging from Santo Domingo in certain stations, through the Antilles, South and Central America to Texas. Fore wing with restricted pink ground, restricted black spotting; hind wing white, with extended black markings, differing strongly in the sexes. The variation is slight on the mainland; as we approach Cuba *venusta* characters appear, apparently quite independently of each other.

U. ornatrix stretchii Butler. Porto Rico; rarer on Hayti and St. Thomas. Fore wing with extended pink ground and spottings; hind wing like *ornatrix.* This is a combination of *ornatrix* and *venusta* characters, but shows a tendency to be restricted to certain stations. Intergrades are proportionately common.

U. ornatrix venusta (Dalman). Jamaica. Fore wing pink, either in the extended (typical) or restricted phase; hind wing pink with black markings restricted, typically to an extreme. In Jamaica this occurs pure, and the form with pale fore wing is not rare; the only other variation is in the width of border of the hind wing, which rarely is as wide as the narrowest *ornatrix ornatrix.* In Cuba and Santo Domingo the typical form is accompanied with intergrades to *bella,* and the phase with pale fore wing seems never to occur.

U. ornatrix bella (L.). United States and Bahamas. Fore wing yellow or orange, contrasting with the pink hind wing, black spotting extended hind wing with intermediate amount of black. Normal variation is moderate except in Cuba, where the fore wing becomes pink; but aberrant forms show the characters normal to all the other forms in isolated condition. For instance: *terminalis* seems to be *bella,* plus the restriction factors of *ornatrix; nova* is *bella* carrying yellow, but in its lack of differentiation between fore and hing wing resembling *venusta.* Specimens from Staten Island, N. Y., in W. T. Davis' collection show the exact combination of characters that reappear in *stretchii,* and if not mongrels with a stray *ornatrix* imported from the south, indicate an interesting parallel variation. Their normal genitalia rule out *pulchella* as a factor, though superficially they suggest it even more strongly than *ornatrix.*

The three figures will bring home the strongly marked character of the Old World species. Fig. 1 would do as well for *bella, stretchii* or *venusta* as for typical *ornatrix*.

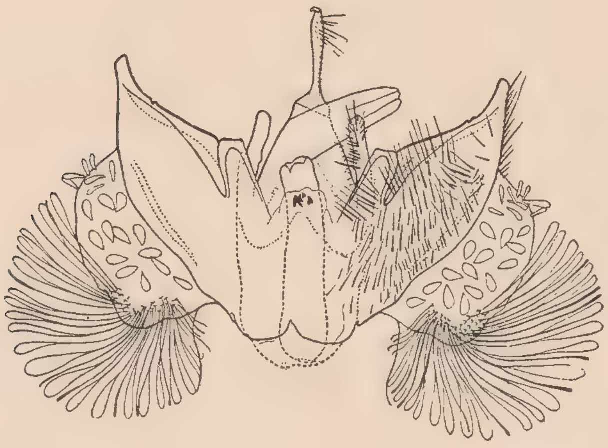
Material from the following localities has been before me:

U. pulchella from Europe, India and Australia.

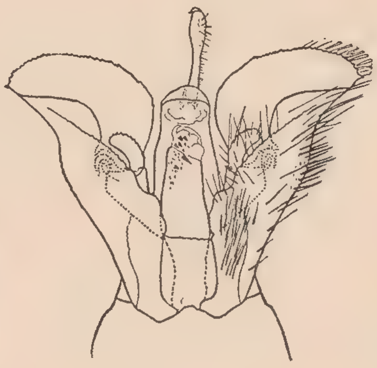
U. semara from Java.

U. elata (Fabr.) from Madagascar.

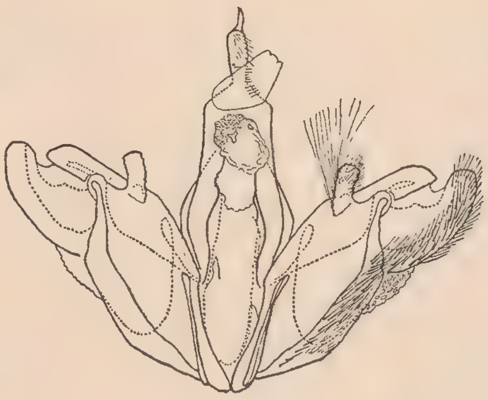
U. ornatrix ornatrix from Texas; Mazatlan and Jalapa, Mexico; Petuc, Honduras; Cauca Valley, Columbia; Peru; Venezuela; Tumutumari, British Guiana; Barbados; Dominica; St. Chistopher; Antigua; St. Thomas; eleven localities in Porto Rico; and Puerto Plata, Santo Domingo.



1



2



3

Fig. 1. *Utetheisa ornatrix* L. Porto Rico. Cat. No. 21693.
Fig. 2. *Utetheisa pulchella* L. India. Cat. No. 21689.
Fig. 3. *Utetheisa semara* Moore. Java. Cat. No. 21706.

U. ornatrix stretchii from St. Thomas, Porto Rico and Sanchez, Santo Domingo.

U. ornatrix venusta from various points in Jamaica.

U. ornatrix in a range of forms, resembling *venusta* or between it and *bella*, from various points in Cuba and Santo Domingo.

U. ornatrix bella in long series from Massachusetts to Florida and Alabama, also from New Providence, Bahama Islands.

III.

In Hampson's Catalogue the name of *Empyreuma pugione* (as of Linnaeus) is applied to the form from Jamaica. A series of thirteen fine specimens in the Museum collection show that while the Jamaica form is a good species the Linnæan name will not fit, aside from the incorrect locality. His description reads:

S. cærulescenti-atra albopunctata, alis rubris margine postico fusco. Habitat in insula S. Thomæ, L. Spengler. Corpus magnitudine S. Filipendulæ, atrum, subcærulescens. Thorax punctis albis sparsis. Abdomen untrinque ordine duplici punctorum alborum. Antennæ utraque extremitate angustiores, subpectinatæ, apice rubræ. Alæ rubræ, immaculatæ, postico tantum margines nigricantes. Pedes nigri.

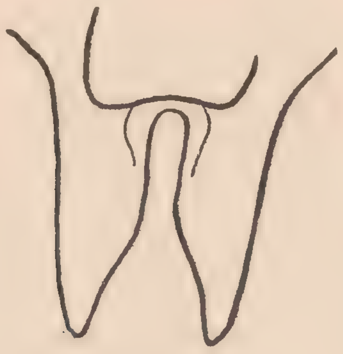
In the locality, white-dotted thorax and abdomen, red fore wings, and size this agrees with the *affinis* group, and contrasts strongly with the Jamaican form. So I would propose a new name for the latter:

Empyreuma anassa n. sp.

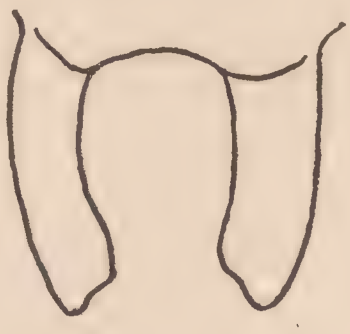
Head and thorax iridescent bronzy black; abdomen more brilliant blue-black, no white dots. Abdomen with a large shining subdorsal bluish white streak on third segment, rarely forming a band across the dorsum, followed by similar progressively smaller spots on one or more segments. Lateral dots minute or absent. Subventral spots sometimes present near base and on sixth segment. Fore wing deep purple shading into blue, black on outer margin. Extreme base of wing black. Costa above radius and base of inner margin scarlet. Veins distinctly dark. Hind wing scarlet, border broad, as in *E. affinis*. Underside scarlet and blue-black, marked as in *E. affinis*.

The much more brilliant coloring with purple-iridescent fore wings, pale silver-blue spots on the sides of the distinctly bluer abdomen, solid black thorax, and pinker hind wing is distinctive. The white subdorsal and subventral spots do not seem as safe. Expanse 47–52 mm. in the material before me. Type male near Troy, June 12, paratypes Montego Bay, Mar. 5, 10; Kingston, Mar. 31, and others with less complete data. The sexes do not seem to differ.

It should be noted that *Zygæna lichas* Fabr. does not belong to this group at all, but is from Arabia, and to judge by its description probably a true Syntomis. The name which applies to a West Indian Form is *Sphinx lichas* Cramer, from St. Thomas, which is very likely a strict synonym of *pugione*. So far as I can find out neither *sanguinosa* Martyn nor *sanguinea* Roth. have ever been published, even by a brief description; as Hampson cites *sanguinosa* to *lichas,* they may be synonyms of *pugione.*



4



5

Fig. 4. *Empyreuma affinis* Roth. Cat. No. 21698.— Uncus.
Fig. 5. *Empyreuma anassa* Forbes. Paratype. Cat. No. 21699.— Uncus.

Summary.

pugione L. St. Thomas, Santo Domingo.
  = *lichas* Cr., *nec.* Fabr.
  = *lichas* Hamp., in part,
  = *sanguinosa* Martyn (?), unpublished.
    which is *sanguinea* Roth. undescribed.
affinis Roth. Cuba; Bahamas;
race *portoricensis* Roth., Porto Rico;
race *haytiensis* Roth., Hayti and Santo Domingo.
anassa Forbes
  = *pugione* Auct., *nec.* L.

IV.

A good series of *Lymire* from the West Indies changes the appearance of the *edwardsi* group somewhat radically. Including the two races or species described below the genus may be analyzed as follows:

Fore wing black, thorax wholly orange, ... *metamelas.*
Fore wing and thorax brown,
  Neck concolorous, ... *strigivenia.*
  Neck fulvous, ... *fulvicollis.*
Fore wing gray or white, thorax concolorous,
  Fore wing gray, vertex yellow, ... *edwardsi.*
  Fore wing white, vertex black, ... *candida.*
Fore wing gray or white, thorax concolorous behind, with yellow collar,
  Abdomen yellow below, ... *melanocephala.*
  Abdomen white below,
    Expanse 25 mm.; dorsal half fore wing shaded with gray, ... *senescens.*
    Expanse 40 mm.; dorsal gray band entirely below fold,
      except near outer margin, ... *albipennis.*

L. edwardsi (Grote). A specimen from Sanchez, Santo Domingo, June 13–18, 1915, and two from El Valle, Santo Domingo, May 2–8, 1916, are exactly like the types and series in the Museum collection from Florida.

Lymire candida n. sp.

Head green-black, with a few paler scales outlining the tuft on the vertex. Palpi black, the front of the second joint whitish, basal joint yellow. Thorax white, a small blackish spot in the middle just behind the collar, ventral half of prothorax and fore coxæ yellow, but shoulders and remainder of under side white. Fore and middle legs dark gray on outer side, hind legs very pale pearl gray. First three segments of abdomen with fine smoky gray hair above, the terminal half clothed with scales, peacock-blue; under side and terminal tuft of male white.

Fore wings white above, hind wings pale pearl gray, nearly transparent except toward margins; middle portion of fore wing and costa of hind wing below shaded with gray. 40 mm. Type male, Sanchez, Santo Domingo, Nov. 26, 1915; paratypes, Sanchez, June and Nov.–Dec. and San Lorenzo, Santo Domingo, June, July 10; 1915.

L. melanocephala Walker. Twelve males and a female from near Troy, Jamaica, May 12–23, agree essentially with Walker's and Hampson's descriptions. The sexes are alike, and in both the end of the abdomen is yellow, above as well as below.

L. albipennis (Herrich-Schäffer). Three males and two females from Matanzas, and a male from Tanamo, Cuba, represent this species. Hampson's figure and description differ in a few points, and may have been drawn up from rubbed specimens. The first segment of the palpus only is yellow, the second gray and white, as implied by Herrick-Schäffer. The collar has a large green-black dorsal spot, and the dorsal edge of the patagia is green-black, except on one specimen in which they are paler gray.

Lymire senescens n. sp.

This dwarf form seems to represent *L. albipennis* rather than *edwardsi* or *candida,* on Porto Rico; the lack of a form of this type from Hispaniola is unexplained, but not improbably one may be discovered in this little known island.

Head blackish, shading into pale gray on occiput; palpi blackish; basal segment yellow, second segment broadly white in front, and narrowly yellow along the inner front edge. Collar, loose hair below collar and fore coxæ yellow, the rest of thorax and abdomen gray above and white below. Terminal half of abdomen with peacock-blue sheen. Abdominal tuft partly white above. Legs white, fore legs dark gray in front, the middle femora with some gray, but tibiæ wholly white. Fore wings white above vein 2, light gray below, with a slight violet tint in the freshest specimens. Hind wings slightly duller gray, the basal half becoming translucent white except on the veins, as usual. Wings below mouse gray, except along costal edge of fore wing. 23–26 mm. Type and a paratype male are from Coamo Springs, Porto Rico, Jan. 6–10, 1915; another paratype male is from Naguabo, P. R., March 7–9, 1914. The female is unknown, but will probably be similar, with the abdomen wholly blackish and blue above, as in *L. albipennis* and *L. candida.*

V.

The Museum series of *Nyridela chalciope,* coming from the vicinity of the type locality, all show yellow antennæ as figured by Hübner. If the antennal character is sound they are distinct from *N. acroxantha.* On the other hand I can distinguish *N. xanthocera* only by its slightly larger average size and possibly a slight difference in genitalia which is more likely to be racial than specific.

59.11, 53.2 : 57.72D

Article XV. — EFFECT OF HUMIDITY ON PUPAL DURATION AND ON PUPAL MORTALITY OF *DROSOPHILA AMPELOPHILA* LOEW.

By Adolph Elwyn.

The following experiments were undertaken at the suggestion of Dr. F. E. Lutz and Prof. R. W. Tower for the purpose of determining the influence of relative humidity, as an isolated factor, on the pupal duration and pupal mortality of the fruit fly, *Drosophila ampelophila* Loew.

To do this efficiently, it is necessary to devise a method for the adequate control and measurement of humidity, since in studying moisture phenomena, three conditions must be fulfilled:—

1. The production and sustained constancy of a desired humidity;
2. The accurate measurement of such humidity;
3. The isolation of humidity from other environmental factors, such as temperature, so as to assure the full and independent effect of the former.

The last condition is easily met. Attention, therefore, was wholly devoted to a satisfactory solution of the first two, a difficulty which in all probability has been the chief cause of the neglect of the humidity factor in environmental experiments.

Two series of experiments were made. The first was an attempt to determine roughly the direction of the effects, if any, of differences in relative humidity. In the second set, strictly controlled conditions were introduced to study the corresponding effects more exactly and conclusively. The strain of Drosophila was supplied by Dr. Lutz. The larvæ were reared in a glass box with side doors, and the newly formed pupæ were collected twice a day and immediately subjected to experimental conditions.[1]

Series I.— This series involved 426 pupæ placed on card-board and suspended in bottles stoppered with cotton under the following conditions:

A — Over water	147 pupæ
B — Empty bottle, hence room humidity	217 pupæ
C — Over calcium chloride ($CaCl_2$)	62 pupæ

Daily tests made with a wet-and-dry-bulb hygrometer gave A = 100 per cent, B = 38–42 per cent (room humidity). C was not measured but was obviously of a low relative humidity. The average temperature was 61°–64° F.

---

[1] Lutz, F. E., Humidity — A Neglected Factor in Environmental Work. American Naturalist, XLVIII, pp. 122–128, 1914.

It may be said here that the wet-and-dry-bulb hygrometer was found altogether inadequate for the measurement of humidity in small vessels. Air which had been repeatedly passed through concentrated H_2SO_4 and over solid KOH, registered as high as 31 per cent when it was undoubtedly dry, and found to be so experimentally by the application of the dew-point apparatus used in series II. This failure of more exact registry is due chiefly to the practical awkwardness of regulating the amount of water necessary for the wet bulb, and of obtaining the passage of a sufficiently swift current of air through the small jars used. In series II, therefore, an apparatus was devised which completely eliminated the use of the wet-and-dry-bulb hygrometer.

Of the 426 pupæ, 383 developed into adults and the length of pupal period is shown in Table I.

Table I.

	Number of Pupae emerged			Percentage of Pupæ Emerged		
No. of days	A	B	C	A	B	C
7	0	1	0		.5	
8	1	1	0	.7	.5	
9	13	12	7	9.0	5.5	11
10	27	28	8	18.4	13.0	13.0
11	36	47	13	24.4	21.6	21.0
12	45	77	11	30.6	35.5	18.0
13	20	28	5	13.6	13.0	8.0
14	0	2	0		.9	
15	0	0	0			
16	0	1	0		.5	
Total	142	197	44	96.7	91	71

Empirical mode of A — 12 days.
" " " B — 12 days.
" " " C — 12 days.

On the surface there is a slight variation in mode in C. But the number used in C was very small, and a statistical examination considering the probable error, shows the variation to be negligible.

The effects on mortality were, however, more striking, as seen in the following table:

Table II.

Experiment	Per cent of Mortality
A	3.3
B	9.0
C	29.0

Here we have a distinct increase in mortality with each corresponding decrease in humidity. Roughly, the effects of changes in relative humidity on length of pupal period were negligible, while the effect on mortality was striking and definite.

SERIES II.— To determine accurately the effect of various relative humidities on the pupal duration and pupal mortality of Drosophila ampelophila, under strictly controlled conditions. Conditions:—

1. The accurate measurement of a given humidity.

Owing to the inadequacy of the wet-and-dry-bulb hygrometer (see above) a new apparatus was devised. This was a modified form of the Regnault dew-point apparatus, similar to the one employed by the U. S. Weather Bureau for determining humidities at high temperature. As shown in the diagram, it consists of a well polished silver tube (a), cemented to a longer glass tube (b) of the same diameter. The cork closing the top is provided with a glass tube (c) going to the bottom of the silver tube and connected with an aspirating apparatus (d); an outlet tube (e), and a delicate thermometer reaching to the center of the silver tube. The whole apparatus slips into a rubber stopper (f) which closes the mouth of the vessel whose humidity is to be determined. To make observations, the silver cup is filled with a volatile fluid, such as sulfuric ether, and the fluid evaporated by means of the constant pressure aspirator until the dew is just deposited, when a reading of the temperature is taken. This is the temperature of the dew-point, and the relative humidity of the atmosphere in the vessel can be found by dividing the vapor pressure at the temperature of the dew-point by the vapor pressure at air temperature. So for instance, if the vapor pressure at dew-point temperature is .0979 and that at air temperature is .595, then the relative humidity to be determined will be $\frac{.0979}{.595} = 16 +$ per cent. For purposes of exactness the silver tube should be permitted to warm up, and readings repeated several times. If the tube is well polished and the observer has had good practice in distinguishing faint depositions of dew, the results will be accurate and consistent and the error negligible.

2. Obtaining and keeping constant a desirable humidity.

All the experiments were conducted in closed vessels to facilitate the constancy of a produced humidity. By introducing respectively dry $CaCl_2$ and water, corresponding relative humidities of 0 per cent and 100 per cent were produced, these humidities being measured by the dew-point apparatus. It was desirable, therefore, to obtain some constant intermediate humidity, say 50 per cent or 60 per cent. Now, saturated salt solutions in closed vessels have a definite vapor pressure, varying with the nature of the salt, and for this reason should give corresponding humidities. Vapor pressures have been experimentally determined for many salts, hence, if the proper salt were selected, the desired humidity would be obtained. For our purpose, the most convenient salt was sodium nitrate ($\mathrm{Na\ NO_3}$), which has a vapor pressure .4393 at 68° F, hence a relative humidity of 64 per cent at that temperature. The numerous determinations with the dew-point

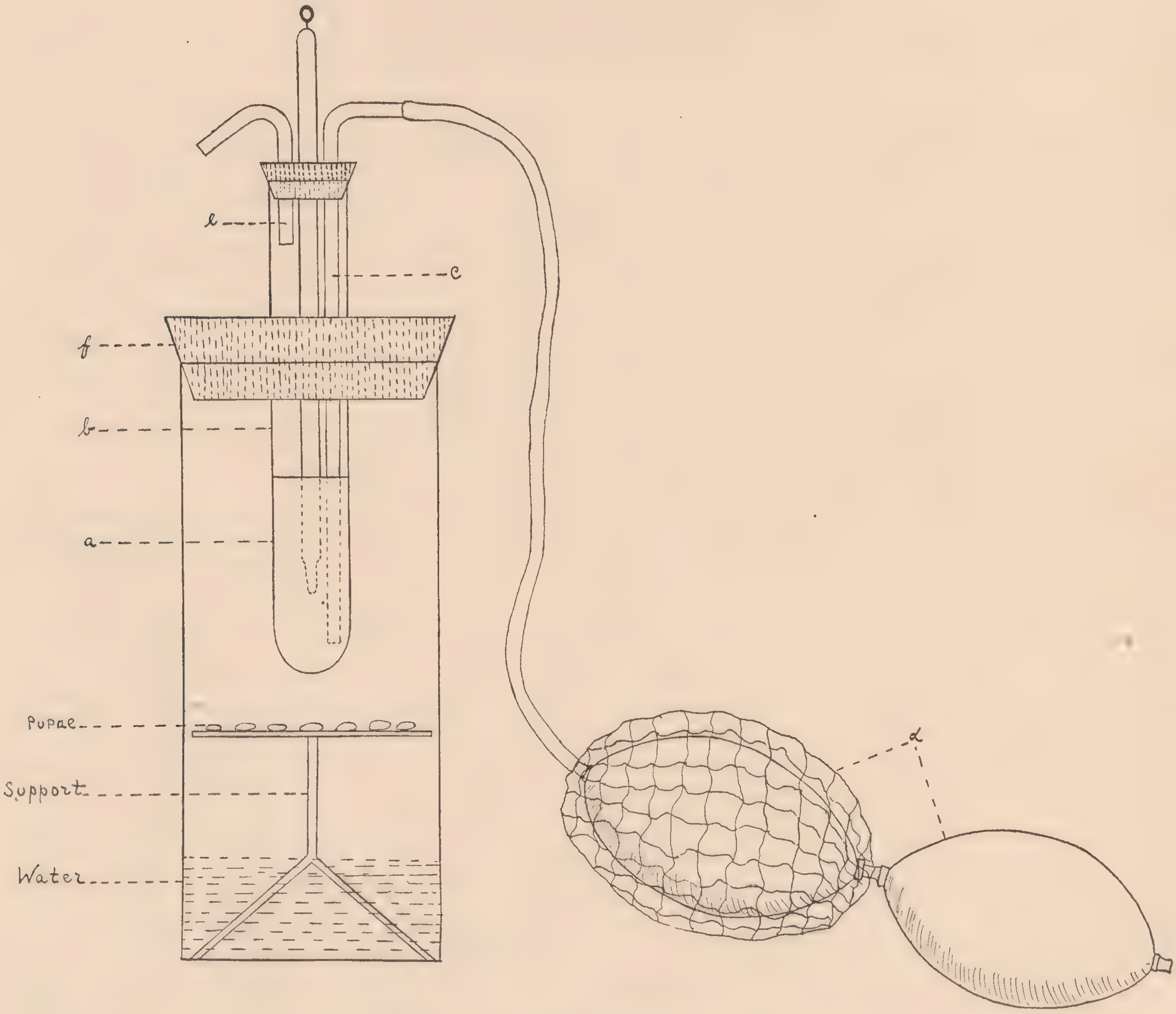


FIG. 1. Dew-point Apparatus.

apparatus gave humidities never less than 61 nor more than 66 per cent. We therefore had three humidities to work with: 100 per cent, 61–66 per cent, and 0 per cent.

The experiments included 1137 pupæ distributed as follows, the average temperature being 65–66½° F.

Table III.

Per cent of Humidity	Number of pupæ
100	401
61–66	333
0	403
Total	1173

Of these 1137 pupæ, 873 developed into adults, and the pupal duration as well as the number emerged is shown in Table 4.

Table IV.

	Number of pupæ emerged			Percentage of pupæ emerged		
No. of Days	100%	68–66%	0%	199	61–66	0
5	0	0	1			.2
6	0	1	1		.3	.2
7	79	55	19	19.7	16.5	4.7
8	205	174	110	51.1	52.3	27.3
9	100	51	51	24.9	15.3	12.7
10	5	10	7	1.3	3.	1.7
11	2	1	1	.5	.3	.2
Total	391	292	190	97.5	87.7	47.0

Empirical mode of 100 per cent, 8
Empirical mode of 61–66 per cent, 8
Empirical mode of 0 per cent, 8

Thus there seems to be no obvious effect on the length of the pupal period, the variations being negligible even under close statistical scrutiny.

On the other hand the influence of changes in relative humidity on mortality is sharply defined, the experiments affirming the results of Series I.

Table V.

Per cent of Humidity	Per cent of Mortality
100	2.5
61–66	12.3
0	52.9

There is therefore no optimum humidity between 0 and 100 per cent which might be called normal, such as W. L. Tower[1] has found with *Leptinotarsa,* but there is a definite decrease in mortality with each corresponding increase of humidity, the optimum being a humidity of 100 per cent, when mortality is so low as to be almost negligible. When we group the pupæ in two divisions, according to their age, a very interesting fact appears. The following table shows a comparison of the total number with that of the two age groups. Of the 1137 pupæ, 366 were 2–8 hours old and 771 were 8–14 hours old, when subjected to experimental conditions.

Table VI.

Comparative Mortality.

	Per cent of Humidity	Per cent of Mortality total number	Per cent of Mortality Age 2–8 Hours	Per cent of Mortality Age 8–14 hours
A	100	2.5	2.2	2.7
B	61–66	12.3	27.3	9.4
C	0	52.9	77.3	34.6

While age is thus of but little consequence in medium A, it nevertheless greatly modifies the action of humidity in the other two media. B shows 27 per cent of mortality for young pupæ and only 9.4 per cent for the older ones; while C gives as high a mortality as 77.3 per cent for young as compared with 34 per cent for older pupæ. These facts are explained by the integumental changes which take place during early pupal life. When first formed the pupa has the pale yellow delicate transparent skin of the larva, and in this stage diffusion probably takes place rapidly. Hence a lowering of humidity would cause a quick evaporation of the pupal moisture with resulting death. But in a few hours the skin becomes brownish, more opaque and chitinized, so that evaporation of moisture takes place with more difficulty. When pupæ of this stage are placed in media of low relative humidity, much of their moisture is retained, and the effects are consequently greatly diminished. It is very likely that a relative humidity of 0 would cause 100 per cent mortality if the pupæ were subjected to such condition immediately after formation.

---

[1] W. L. Tower, — Evolution in Chrysomelid Beetles of the Genus Leptinotarsa. Carnegie Institution of Washington, 1906, Publ. No. 48.

SUMMARY.

1. Changes in relative humidity have no marked effect on the length of pupal period of *Drosophila ampelophila.*
2. Changes in relative humidity produce striking changes in the mortality of *Drosophila,* the mortality increasing with a decrease of humidity. The optimum humidity being 100 per cent.
3. The effects of low humidity on mortality are most marked with very young pupæ, whose covering permits a rapid evaporation of body moisture. After a few hours, when integumental changes making evaporation more difficult have set in, the effects of low humidity are correspondingly decreased.

56.81, 9S

Article XVI. — CRITERIA FOR THE DETERMINATION OF SPECIES IN THE SAUROPODA, WITH DESCRIPTION OF A NEW SPECIES OF *APATOSAURUS*.

By Charles C. Mook.

The present paper is based upon studies made under the direction of Professor Henry Fairfield Osborn in connection with the latter's monograph on the Sauropoda now in course of preparation.

In this work the question of species and specific criteria has been a troublesome one. Marsh and others have used characters of size and slight differences in morphological structure, with little or no regard to their ontogenetic significance or their dependence on individual variation. In some cases authors have made generic descriptions answer for both generic and specific designations, leaving it for future revisers to select specific characters. A study of the value of various characters as specific criteria in the Sauropoda may perhaps be discussed advantageously at the present time.

Size has been used to a considerable extent both as generic and specific characters. If the size of two *adult* animals differs appreciably while their morphological structures remain practically the same, it seems reasonable to assign them to different species. If two individuals of the *same size* show considerable differences in their ontogenetic characters they may be considered as belonging to different species. If the larger of two animals, however, exhibits adult or old-age characters, while the smaller one possesses juvenile characters, it is by no means allowable to assign the two forms to different species on the ground of size alone, unless this difference is excessively great. In the case of reverse conditions, the smaller animal exhibiting characters of a later ontogenetic stage than the larger animal, it is certainly allowable to assign the two individuals to different species on the ground of difference in size. Size, then, is a reliable specific character when applied to individuals of the same ontogenetic stage, but may or may not be reliable when applied to individuals of different ontogenetic stages.

Ontogenetic characters have been used frequently as specific characters. Their use must be associated with that of some other kind of character, such as size, to be reliable. Ontogenetic characters which are frequently used are: union of neural arches and centra of vertebræ by suture or by complete coalescence; the presence of three, four, five, or six vertebræ in the sacrum, and the relative amount of coalescence of these with each other; coössification or separation of scapula and coracoid, or scapula and suprascapula; thickness or thinness of bones which would be cartilaginous in young stages, such as the sternum; to a certain extent the degree of separation of processes of bones, such as vertebral laminæ, zygapophyses, trochanters, etc.; the degree of development of rugosities for muscular and ligamentary attachment; perhaps the number of vertebræ bearing transverse processes; [this character must be considered as ontogenetic with caution as it may represent real morphologic difference]; relative differences in size and proportions between different bones or regions of the body; possibly in differences in the size of certain parts of the body only, which are similar in character; the degree of definiteness of outlines of bones, etc.

Slight morphological differences are often used as specific criteria in the Sauropoda. In order to be sure that these are not merely individual variations one must study all the material available, and determine, if possible, just what the range of variation is. Individual variation plays a very important part in sauropodan morphology, and if one were to consider all minor variations as having specific value, it is possible that every known sauropod specimen of any considerable degree of completeness would be considered as belonging to different species. By comparing a large amount of material, however, the range of individual variation can be determined with a reasonable degree of accuracy, and characters of this sort distinguished from characters definite and constant enough to have specific value.

The *order of differentiation of parts* may possibly be considered as a criterion for distinguishing species. The primary sauropodan sacrum, for instance, has three vertebræ, the typical adult sacrum five vertebræ, and occasionally an old individual has six. The order of addition of the extra vertebræ to the primary sacrals, whether first the caudo-sacral and then the dorso-sacral, or the reverse, may perhaps have specific value.

A type of specific criterion which has considerable value when sufficient material is preserved in a skeleton to allow its use, is that of *acceleration* and *retardation.* It sometimes happens that a certain individual exhibits in general characters showing a certain stage of development, while some particular portion of the skeleton may belong to a stage much younger or older than that indicated by the rest of the characters of the animal. In the former case we have *retardation* which respect to the given portion of the body, and in the latter case *acceleration.* If we have two individuals which show by their morphological characters that they belong to the same genus, but with one having a greater degree of acceleration or retardation in respect to certain characters, or one individual normally developed and the other decidedly accelerated or retarded, the two individuals clearly belong to different species.

In applying the above-mentioned criteria to the genus *Apatosaurus*, it appears that the well-preserved sacrum and pelvis of No. 675 of the American Museum collections belongs to a species of *Apatosaurus* which has not hitherto been described. This sacrum has been described and figured by Osborn in 1904. It consists of six sacral vertebræ (two dorso-sacrals, three primary sacrals, and a caudo-sacral). The size of both sacrum and pelvis is much smaller than that of the type specimen of *A. ajax*, or of *Brontosaurus excelsus*. All six vertebræ are coalesced by their centra, and all are attached to the ilia, otherwise the first and last of the series resemble a dorsal and caudal respectively, more than they do the primary sacrals. The first dorso-sacral is attached to the ilia by rather long ribs resembling those of the dorsal vertebræ. These ribs distinctly have shaft, tuberculum, and capitulum. The articulation of the tuberculum with the diapophysis is very distinct, and is well shown in the figure of the anterior end of the sacrum. The capitular articulation with the capitular facet is traceable, but less clearly so, and is not shown in the figure. The distal ends of the ribs are expanded; they attach with the ilia near the tips of the anterior processes of the latter. The second dorso-sacral is attached to the ilia in much the same way as the first. Its rib is much shorter and thicker, however, and the capitular attachment to the vertebra is not visible on the specimen. The union of the tuberculum of the rib with the diapophysis is still clearly visible. This rib is connected with that of the first dorso-sacral by a short, slender antero-posterior bar. The inferior portions of the articulations of the primary sacrals are not visible from above. The superior attachments in primary sacrals 1 and 2 are clearly of the dorsal type, with well-developed diapophyses. There appear to be very short ribs between the diapophyses and the ilia. This point requires further study, however. The 3rd primary sacral resembles a caudal in form, having a broad, thin plate for a transverse process instead of a diapophysis which is thick antero-posteriorly and thin vertically. This suggests that the ultimate origin of the three primary sacrals is from two dorsals and one caudal. The caudo-sacral is attached to the ilia by broad transverse processes which have no suggestion of division into diapophysis, parapophysis, and rib. They are supported posteriorly by a process which extends backward to the posterior border of the centrum. The sacro-costal yoke is made up of the coalesced inferior rib articulations of the second dorso-sacral and three primary sacrals, with which the lower part of the transverse process of the caudo-sacral is also united. Its inferior surface forms part of the acetabulum, a characteristic sauropodan feature which will be discussed by Professor Osborn in the paper on the *Camarasaurus* sacrum. The spines are rather slender compared with those of most *Apatosaurus* sacra, such as the mounted specimen in the Field Museum. The spines of the second dorso-sacral and primary sacrals 1 and 2 are firmly coalesced with each other, while that of primary sacral 3 is partially coalesced with that of the second primary sacral. The spines of the first dorso-sacral and the caudo-sacral are entirely free. The inferior portion of the sacral rib of primary sacral 2 has an oblique ridge on its inferior surface resembling those present in the types of *A. ajax, Brontosaurus excelsus,* and *B. amplus,* This is a characteristic structure in *Apatosaurus.* The inferior surfaces of the centra are broadly rounded, contrasting with those of *Diplodocus.* The inferior portions of the sacral ribs are not twisted as in *Camarasaurus.* These characters together with the tall spines which have the characteristic *Apatosaurus* lamination indicate conclusively that the specimen under consideration belongs to the genus *Apatosaurus.* Most or all of the other known sacra of *Apatosaurus* are much larger and have fewer vertebræ. That in the type of *Brontosaurus excelsus* has six, but the first is united by the centrum only, and the whole sacrum is much larger than the present specimen. Those of the types of *A. ajax* and *B. amplus* are both much larger than the present one and have four and five vertebræ respectively.

The present specimen, with its six sacra firmly attached to the ilia and its small size evidently belongs to a different species from the gigantic sacra of the species mentioned above, with their lesser, or at any rate not greater number of sacrals. This species may be called *Apatosaurus minimus,* in allusion to its being the smallest known species of the genus. It may be characterized briefly as follows: small size, very strong sacrum, with six functional vertebræ in the adult, and also by the very slightly expanded distal end of the ischium.

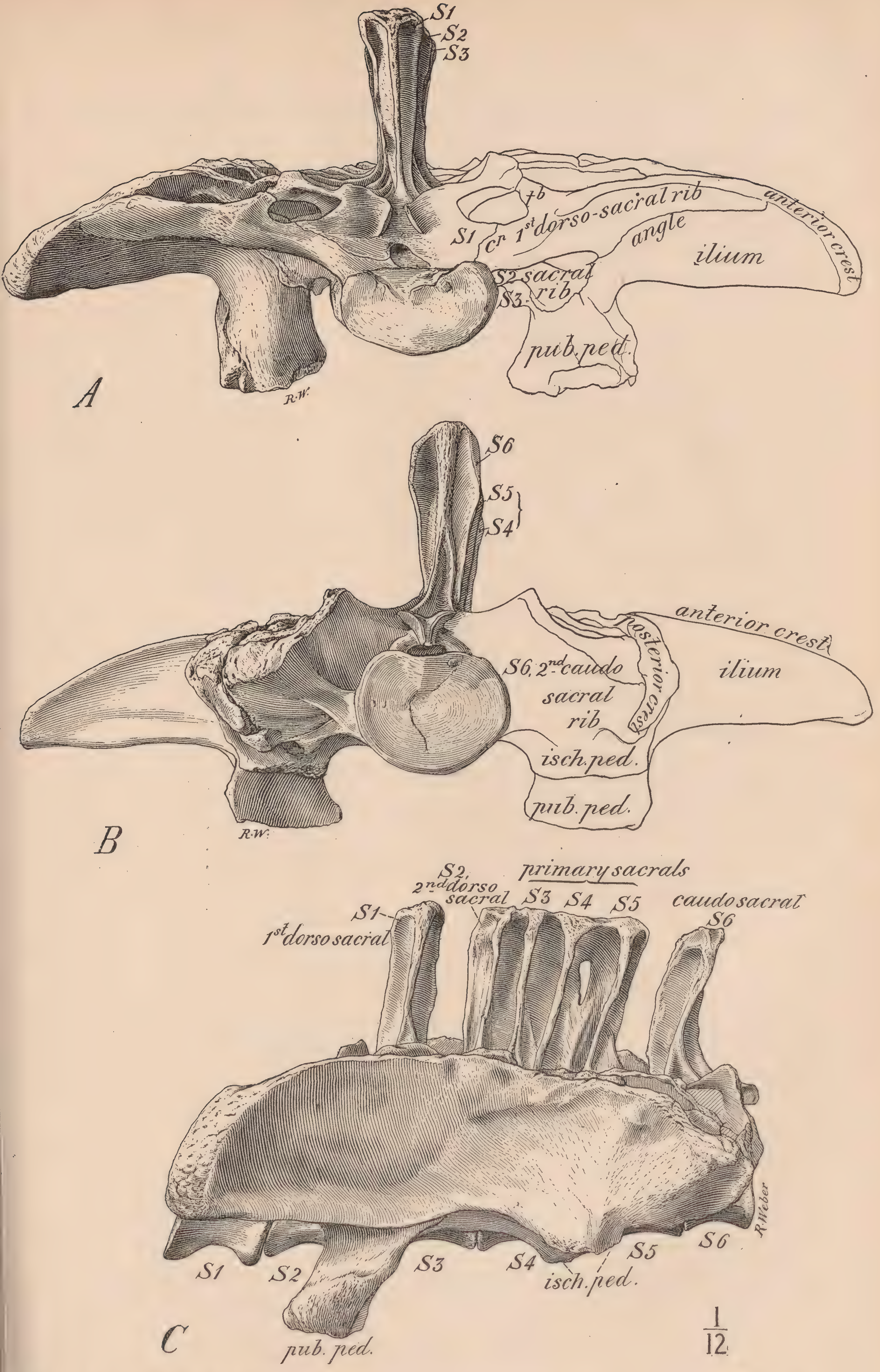


Fig. 1. *A.* Anterior view of sacrum and ilia of *Apatosaurus minimus*, sp. nov. ½ natural size, after Osborn.
B. Side view of the same, after Osborn.
C. Posterior view of the same, after Osborn.

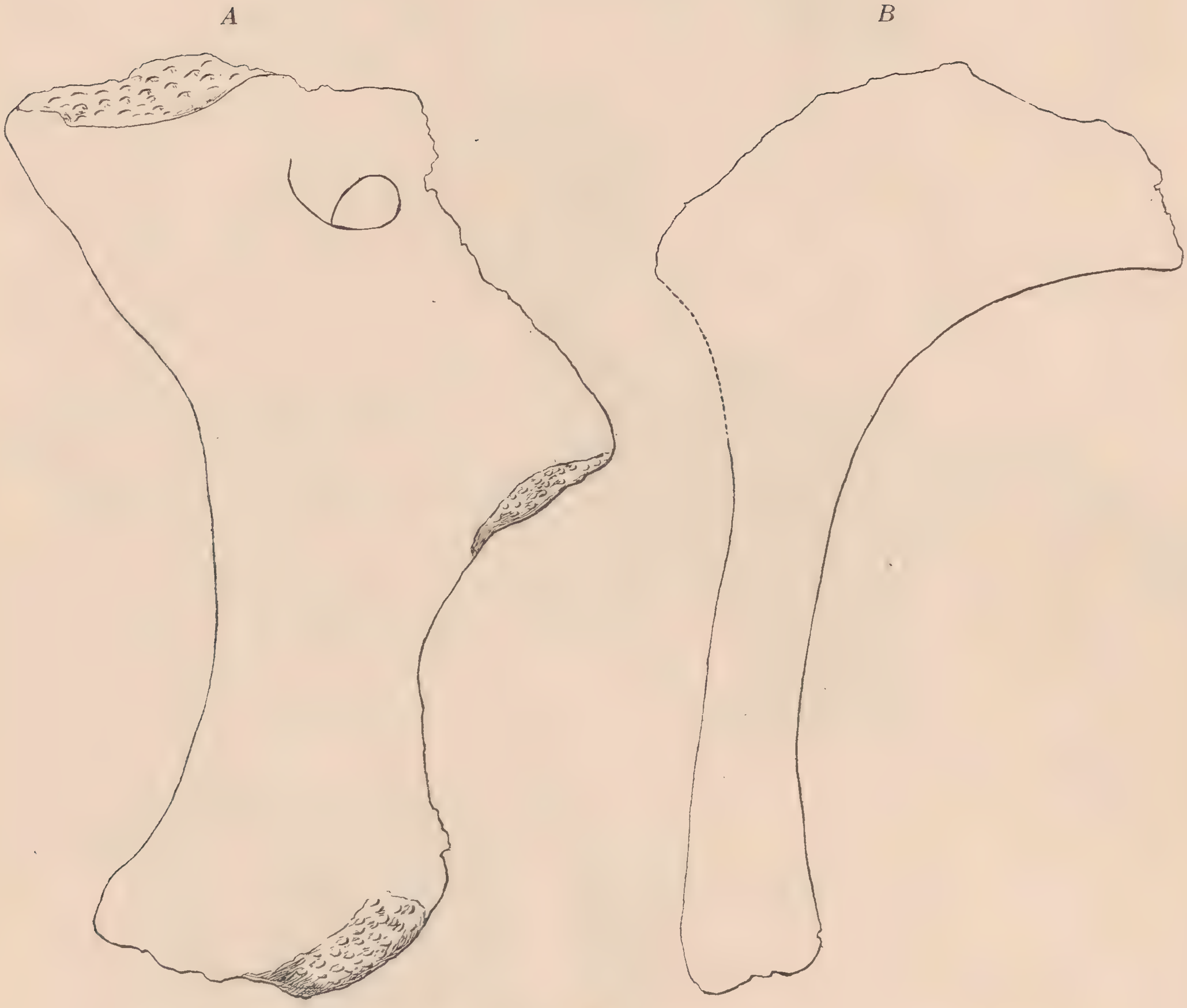


Fig. 2. *A.* Outline of right pubis of *Apatosaurus minimus*, $\frac{1}{12}$ natural size.
B. Outline of right ischium of *Apatosaurus minimus*, $\frac{1}{12}$ natural size.

59.9, 53K : 14.71, 5

Article XVII.— THE SKULL OF *KOGIA BREVICEPS* BLAINV.

By H. von W. Schulte.

Plates XXXV–XLIII.

Page.
Introduction 361
List of specimens of *Kogia* 361
Historical 364
Measurements 364
The skull as a whole 368
The cranial bones 383
Comparison of *Kogia* and *Physeter* 399

Introduction.

In the collections of the American Museum of Natural History are two skeletons of *Kogia breviceps*, one of an adult female of large size and one of a calf roughly two-thirds grown. The latter was young enough to disarticulate in part and thus afforded an unusual opportunity to study this highly specialized cranium. For permission to utilize this material, I am indebted to the courtesy of the officers of the Museum, in particular to the Staff of the Department of Mammalogy, and I would express to them my sincere appreciation of their many kindnesses in the course of this study.

List of Specimens of Kogia.

The specimens of *Kogia* noted or described by naturalists are so few that they are for convenience of reference listed below in chronological order together with the more important literature dealing with them severally.

(1). *Physeter breviceps.* A skull from the Cape of Good Hope collected by Jules Verreaux and placed in the Paris Museum. Of this de Blainville (1838) published illustrations and gave a brief description. Though shown in his cut, in his text there is no mention of the mid-facial crest which forms so striking a character of the *Kogia* skull and at once distinguishes it from *Physeter*. Gray (1846, 1850) too is silent concerning it, although rightly separating the new form from the genus *Physeter*. To him is due the not universally admired term *Kogia*. In 1866 he reproduced de Blainville's figures, printing that of the vertex reversed so that the right blow-hole is shown as the larger and the mid-facial crest is convex dextrad. Owen (1869) reproduces the profile from the same source and his cut differs from Gray's in the direction of enhancing the individual peculiarities of this skull. Finally there are excellent illustrations of this type specimen in van Beneden and Gervais (pl. xx, figs. 1–2).

(2). *Euphysetes grayii.* An adult stranded at Maroubra Beach, the carcass much damaged, the skeleton all but complete; collected and placed in the Australian Museum by Wall, who published an account very adequate except in the matter of illustrations (1851). He was able to locate the single blow-hole near the middle of the head and describes the falcate dorsal hump. The mid-facial crest formed by the left maxilla and right premaxilla forms a "prominent thick and sinuated ridge" which is "twisted toward the left side of the head." Mislead by the silence of Gray regarding this character, Wall established a new genus for his specimen, though entertaining some doubt of the validity of the differences between it and the Paris skull, which he suspected had been badly described. The rights of Wall in the work which bears his name have been denied by Gray on a statement from Krefft to the effect that it was in its entirety written by Macleay. In this he is followed by Owen. The charge is a grievous one, for the association of his name with his work is the chief reward of the man of science, and the appropriation of another's honor is a peculiarly vile and heinous crime. At this distance of time it is impossible to ascertain the rights of the case and Gill has pointed out that during his lifetime Macleay raised no question of the authorship of the paper. So the matter must rest, yet the incident is eloquent of the lasting smirch that attaches even to the suspicion of such guilt and ought to serve as a deterrent to the parasitic ambition that covets the credit of another's work.

(3). *Physeter* (*Euphysetes*) *simus.* A female measuring 7 ft. 2 in. in length, with young, collected in the Madras Presidency by Walter Elliot in March 1853. The fœtus was large enough to be skinned and stuffed but unfortunately while left to dry was carried off by a jackal. Of the adult Elliot had drawings made; a first set proving unsatisfactory they were made again, but the unsatisfactory ones were not destroyed. Eventually both sets, together with Elliot's notes and measurements, were forwarded to Professor Owen. Before reaching him an unworthy hand had supplied one of them with a penis, so that Owen, who has himself alone to blame for his disregard of the accompanying memoranda, was led into the error of describing the characters of both sexes from a single specimen (1865). The description given of the skull is the most complete and thorough in the literature. In 1867 Elliot furnished the necessary corrections and gave his own measurements of his specimen, which had attained a length only of 7 ft. 2 in. although it was sexually mature.

(4). *Euphysetes macleayii.* Stranded at Manly Beach near Sidney, and described by Krefft (1865). Krefft sent photographs of this specimen to the Exposition of 1867 at Paris and there is an excellent illustration of it in van Beneden and Gervais which supplies information not to be obtained from the wretched wood-cuts of Krefft's original article.

(5). *Kogia floweri.* A specimen observed by Col. Grayson at Mazatlan, Lower California, of which a portion of one mandible came into the hands of Gill (1871), together with notes upon its external characters.

(6 and 7). *Kogia macleayii.* Gray (1873) records the presence in the British Museum of two specimens from Australia. These are notable as being the first examples of *Kogia* which were not made the basis of new species. It is possible that one of these served as the material for Beddard's description of *K. breviceps* (1900).

(8). *Euphysetes pottsii.* Stranded near Governor's Bay, New Zealand, measured and notes made upon the osteology and external characters by Haast (1873, 1874).

(9). *Kogia breviceps.* From Japan, described and beautifully figured (pl. xli.) by van Beneden and Gervais (1880). The only satisfactory view published of the basis cranii is the one given of this specimen.

(10 and 11). *Kogia.* A jaw in the Royal College of Surgeons. Van Beneden and Gervais (pl. xx, fig. 3). There is a similar fragment in the Hunterian Museum.

(12). *Kogia grayi.* A specimen acquired by the Australian Museum. Haswell has described its brain (1883).

(13). *Cogia breviceps.* A male stranded on the coast of Otago, New Zealand, the soft parts of which and later the skeleton were described by Benham (1901, 1902). His notes upon the skull are intentionally brief because of previous descriptions.

(14). *Kogia breviceps.* Benham mentions a specimen at Napier lacking teeth in the upper jaw.

(15 and 16). *Kogia breviceps.* Two skeletons in the South African Museum, from Greenpoint and from Knysna. Sclater gives measurements of both and cuts of the skull of one of them (1901).

(17). *Kogia breviceps.* A skull in the United States National Museum of which excellent photographs are given by Elliot (1904).

(18). *Kogia breviceps.* A male stranded at Roscoff, France. Careful descriptions are given of the soft parts of the head, of some of the viscera, together with measurements of the skeleton by Le Danois (1910, 1911).

(19). *Kogia breviceps.* A specimen stranded at Ile d'Oléron, collected by Bernard, mentioned by Le Danois.

To these may be added two skeletons of *K. breviceps* in the American Museum of Natural History.

(20). An immature individual obtained by Frank Wood at New Bedford, Mass. No. 34867.

(21). A large female with young collected by R. C. Andrews, having come ashore at Long Beach, Long Island. No. 36595.

HISTORICAL.

Upon the individuals above enumerated three genera have been formed, *Kogia* (Gray, 1846), *Euphysetes* (Wall, 1851) and *Callignathus* (Gill, 1871). *Euphysetes* was founded upon an omission in the definition of *Kogia*, as has already been stated, and this supplied (Gray, 1866), must plainly be dropped. *Callignathus* was proposed for *P. simus* of Owen, characterized in the first line by the presence of teeth in the upper jaw, further by the rounded proximal extremity of the mandible, the short rostrum, and the incurved extremities of the transverse crest. This skull has other small peculiarities, as will be noted below, but the proposed genus has not been favorably received and has no supporter among subsequent investigators.

Six species were based upon hardly more specimens. Hector expressed the opinion in 1873 that there was but one species of *Kogia*, in which later writers have concurred with the single exception of Beddard (1900), who considers that there are at most three. For him *K. breviceps* includes *K. macleayi* and *K. grayi;* *K. simus* is a valid species; and *K. pottsii* less certainly established; *K. floweri* is too vaguely characterized for recognition. Le Danois (1911) has thoroughly reviewed the question and concludes that there is ground for accepting but one species, *K. breviceps* (de Blainville).

MEASUREMENTS.

The general dimensions of the skull in the American Museum are given below, together with such similar measurements as can be gathered from the literature; in most of the notices of *Kogia* the proportions of the skull and the cranial osteology receive but scanty attention and it has almost become a custom among students of this genus to refer to the accounts of Wall, Owen, van Beneden and Gervais, as containing all that need be known of the cranium.

Measurements of Skull.

	Wall	Owen	Le Danois	Am. Mus., Adult 36595	Am. Mus., Calf [illegible]
Length of skull from extremity of snout to hinder edge of occipital condyles	$16\frac{1}{2}$ in.	$10\frac{5}{12}$ in.	40 cm.	17 in.	$12\frac{1}{4}$ in.
Ditto from hinder edge of occipital condyles to hinder wall of nares	R. 6 in. L. —	R. — L. $4\frac{5}{6}$ in.	10 cm.	R. $7\frac{1}{4}$ in. L. $6\frac{7}{8}$ in.	R. 6 in. L. $5\frac{1}{2}$ in.
Length of rostrum from its extremity to the fundus of antorbital notch of the maxilla	7 in.	5 in.	20 cm.	$9\frac{1}{2}$ in.	$6\frac{1}{2}$ in.
Breadth of head between postorbital processes — maximum breadth	14 in.	$9\frac{5}{12}$ in.	34 cm.	$14\frac{7}{8}$ in.	11 in.
Breadth of rostrum between antorbital processes of maxilla	8 in.	$4\frac{3}{4}$ in.	18 cm.	$8\frac{7}{8}$ in.	$5\frac{7}{8}$ in.
Ditto midway between its extremity and the antorbital processes	5 in.			$5\frac{1}{2}$ in.	4 in.
Ditto at its extremity	2 in.	$1\frac{1}{3}$ in.			2 in.
Distance between tips of premaxillaries	$1\frac{1}{4}$ in.	$\frac{1}{3}$ in.		$\frac{1}{2}$ in.	
Left nostril, length	2 in.	$1\frac{5}{12}$ in.	4 cm.	$2\frac{1}{4}$ in.	2 in.
" " breadth	$2\frac{1}{5}$ in.	1 in.	3 cm.	$1\frac{3}{4}$ in.	$1\frac{5}{8}$ in.
Right nostril, length	$\frac{1}{2}$ in.	$\frac{7}{24}$ in.		$\frac{5}{8}$ in.	$\frac{1}{2}$ in.
" " breadth	1 in.	$\frac{1}{3}$ in.	1.5 cm.	$\frac{3}{4}$ in.	$\frac{3}{8}$ in.
Width of occipital foramen	$1\frac{1}{2}$ in.	$1\frac{1}{4}$ in.	4 cm.		$1\frac{1}{2}$ in.
Distance between lateral margins of condyles	4 in.	$2\frac{3}{4}$ in.	8 cm.		3 in.
Greatest breadth of occipital	11 in.	$6\frac{1}{6}$ in.	25 cm.	$12\frac{1}{2}$ in.	$9\frac{1}{4}$ in.
Greatest height of occipital	11 in.			$11\frac{1}{4}$ in.	$8\frac{1}{2}$ in.
Length of mandible	$13\frac{1}{4}$ in.	$8\frac{1}{2}$ in.	34 cm.	$16\frac{3}{4}$ in.	11 in.
Length of symphysis	$3\frac{1}{2}$ in.	$2\frac{1}{3}$ in.	7 cm.	$4\frac{1}{2}$ in.	$1\frac{3}{4}$ in.

Measurements of Skull — Continued.

	Wall	Owen	Le Danois	Am. Mus., Adult	Am. Mus., Calf
Length of alveolar portion	$5\frac{1}{4}$ in.	$2\frac{2}{3}$ in.	13 cm.	$7\frac{1}{8}$ in.	4 in.
Width at proximal end of the symphysis	$1\frac{1}{4}$ in.	$\frac{3}{4}$ in.		1 in.	$\frac{5}{8}$ in.
Distance between outer edges of articular condyles	13 in.		30 cm.		
Height of mandible in pars papyracea	$4\frac{1}{4}$ in.	$2\frac{1}{12}$ in.	9 cm.	$4\frac{1}{8}$ in.	$3\frac{3}{8}$ in.

The three large skulls (Wall, Le Danois, the adult of the American Museum) agree in general dimensions quite closely and appear to represent conditions in the full grown animal. They show the greatest variation in the length of the rostrum. The skull recorded by Le Danois, that of a male, is intermediate in length between that described by Wall, sex unknown, and the female in the American Museum. In other respects the differences are slighter; the Le Danois skull however is distinctly narrower than the other two.

For some of the more important dimensions of the skull additional data are available. Those serving for an estimate of the proportion of the skull to the trunk are as follows:

Length of Skull and Percentage of Skull Length.

Observer	Sex	Total length	Length of skull	Percentage Length of skull
Wall, 1851		9 ft.	$16\frac{1}{2}$ in.	14.8
Krefft, 1865		10 ft. 4 in.	18 in.	14.1
Owen, 1868	♀	Elliot, 7 ft. 2 in.		12.1
		Owen, 6 ft.	10 in. 5 lines	14.4
Gray, 1873		9 ft.	16 in.	14.8
Haast, 1873	♀	7 ft. 2 in.	$13\frac{1}{2}$ in.	15.7
Sclater, 1901	♀	5 ft. 9 in.	10 in.	14.5
Benham, 1902	♂	7 ft. $11\frac{1}{2}$ in.	$15\frac{1}{2}$ in.	15.7

The head is therefore approximately one-seventh of the body length, a proportion which is subject to little variation. An important exception occurs only in the Elliot-Owen specimen. Here there is perhaps a possibility of error although the greater length is that given by Elliot from actual measurements, while the external dimensions of Owen were calculated from the drawing which was not to an exact scale. Elliot in his letter refers to crania of the Wongu, though nothing in Owen's article implies that he received more than one.

In the relation of breadth to length of the skull, the Elliot-Owen specimen again stands somewhat apart from the others, as appears in the following table:

Proportion of length of Skull to Breadth.

			Length of skull	Breadth of skull	Proportional breadth
Wall			$16\frac{1}{2}$ in.	14 in.	84.8
Owen	♀		$10\frac{5}{12}$ in.	$9\frac{5}{12}$ in.	90.4
Haast	♀		$13\frac{1}{2}$ in.	$11\frac{1}{5}$ in.	82.9
Sclater	♀	(1)	10 in.	$8\frac{1}{2}$ in.	85.0
		(2)	15 in.	13 in.	86.7
Le Danois	♂		40 cm.	34 cm.	85.0
Am. Mus. Adult	♀		17 in.	$14\frac{7}{8}$ in.	88.2
" " Calf			$12\frac{1}{4}$ in.	11 in.	89.8

The Owen specimen and that of Haast have the same length, 7 ft. 2 in., and both are females, yet they represent the extremes of variation in this ratio. The specimen of Haast is a large headed individual, while that of Owen is in this respect the smallest of the series. It seems probable that the real variable is the length of the rostrum, and it is noteworthy as shown in the following table that the proportionally shortest rostrum belongs not to Owen's but to Haast's specimen.

Proportional Length of Rostrum to Skull.

	Length of skull	Length of rostrum	Percentage of length of rostrum
Wall	$16\frac{1}{2}$ in.	7 in.	45.5
Owen	$10\frac{5}{12}$ in.	5 in.	46.1
Haast	$13\frac{1}{2}$ in.	$5\frac{1}{5}$ in.	39.7
LeDanois	40 cm.	20 cm.	50.0
Am. Mus. Adult	17 in.	$9\frac{1}{2}$ in.	56.8
" " Calf	ca $12\frac{1}{4}$ in.	ca $6\frac{1}{2}$ in.	53.0

The length of the mandible is roughly the same as the breadth of the skull. Its proportion to the length of the skull varies within wide limits but naturally in the same sense as the length of the rostrum. But these proportions do not depend upon sex nor do they seem to bear a definite relation to the size of the animal.

Proportional Length of Mandible to Skull.

	Sex	Length of skull	Breadth of skull	Length of mandible	Breadth between condyles	Proportional length of mandible to length of skull
De Blainville		$15\frac{5}{12}$ in.		$13\frac{10}{12}$ in.	$12\frac{3}{4}$ in.	89.7
Wall		$16\frac{1}{2}$ in.	14 in.	$13\frac{1}{4}$ in.	13 in.	80.0
Owen-Elliot	♀	$10\frac{5}{12}$ in.	$9\frac{5}{12}$ in.	$8\frac{1}{2}$ in.		80.0
Sclater	♀	10 in.	$8\frac{1}{2}$ in.	$8\frac{1}{2}$ in.		85.0
Sclater	♂?	15 in.	13 in.	14.5 in.		96.7
Le Danois	♂	40 cm.	34 cm.	34 cm.	30 cm.	80.5
Am. Mus. Adult	♀	17 in.	$14\frac{7}{8}$ in.	$16\frac{3}{4}$ in.		98.3
Am. Mus. Calf		$12\frac{1}{4}$ in.	11 in.	11 in.		89.8

It would seem therefore that the proportions of the skull of *Kogia* vary in wide limits and these variations are not in the present condition of the record to be assigned to age or sex. The high proportional variability is no doubt in part to be attributed to the varying length of the rostrum, which would indicate that its extreme shortening was a comparatively recent acquisition, perhaps still progressing and not yet become definitely fixed in its degree. In this respect the comparison of the Owen-Elliot and the Haast specimens are particularly instructive for both are females and of equal length. It is much to be regretted that the length of the rostrum of the smallest female, that of the South African Museum, is as yet unrecorded. In the largest specimen of this sex at present known both rostrum and jaw are of excessive length.

THE SKULL AS A WHOLE.

For the study of the cranial osteology of the adult the chief sources are, first, the imperfect type specimen in the Paris Museum which has been described and figured by de Blainville; Gray (1866) and Owen (1869) have reproduced his cuts, and the specimen has been again and more exactly illustrated by van Beneden and Gervais (1880); second, the description of the Maroubra specimen by Wall (1857); and third, Owen's careful and well illustrated account of the skull from India (1869). There is further an excellent illustration of Krefft's specimen in van Beneden and Gervais (pl. xxii, fig. 8), and these authors give also a description and several figures of a skeleton obtained from Japan (p. 514 and pl. xli), among them the most satisfactory view of the basis cranii that has been published. Sclater has figured the skull of one of the South African individuals. Finally very excellent photographs of the skull in the United States National Museum are given by Elliot.

In cranial characters Owen's specimen stands somewhat apart from the others, which form a fairly homogeneous group, though showing minor peculiarities among themselves. With them the skull, of the American Museum agree in essentials. That of the adult has been photographed in three views, the norma occipitalis being omitted because of extensive deformation by disease about the foramen magnum.

Norma lateralis.— In the lateral view this skull resembles with minor differences de Blainville's figure as reproduced by Gray. The concavity of the supraoccipital is somewhat less and the condyle is not so projecting. Both of these characters are exaggerated in Owen's cut. The lachrymal and the supraorbital process are more produced and tapering and the frontal ascends further between the maxilla and the supraoccipital. The lateral surface of the maxilla has much the same extent but there are minor peculiarities in the maxillo-malar suture. This on the left side approaches the shape of a very wide inverted W in the skull here described, the maxilla jutting ventrad in three projections of which the middle is the largest. The reëntrant angles between it and the other projections are somewhat rounded, especially the rostral one. The angulation is lacking on the right side and the suture forms a sinuous line, as is the case of both sides of the skull of the calf. In this the malar is triangular with prominent convex dorsal angles, which may be taken as a juvenile character. With the development of these angles into diverging processes the malar acquires a triradiate form and the maxillo-malar suture becomes angulate eventually approaching the shape of a W. Its configuration varies not a little. In the Paris skull the suture courses forward from its deepest point in an upward sweep, which is very pronounced in Owen's cut, where also the change of direction in the caudal segment is minimized. There is a well marked supraorbital notch in the skull here described which does not appear in any of the figures of the Paris specimen. The temporal fossa has the same contours in both, but the fronto-squamous suture is placed more caudally in the Paris skull, indicating the greater participation of the frontal in the wall of the fossa. Owen has added a horizontal line across the squama which can hardly be a suture.

In Wall's specimen the frontal is represented as ascending with a long slender falciform process between maxilla and supraoccipital, the maxillo-malar suture is nearly horizontal and the maxilla has a quadrangular lateral surface; the temporal fossa is more rounded. In other respects the resemblance to the skulls in the American Museum is exact, but with regard both to resemblance and the differences the very crude character of the plate must be borne in mind.

Krefft's individual has a stubby postorbital process and a blunt free extremity of the malar. The frontal does not ascend between the maxillary and supraoccipital. The temporal fossa has a greater sagittal extent. The concavity of the occiput is marked, the prominence of the condyle but moderate. The lateral surface of the maxilla is very high and the caudal process of the malar is broad, obliterating the angulation of this half of the maxillo-malar suture.

The specimen from Japan is remarkable for the extension of the frontal to the vertex as a thin strip of bone between the occipital complex and the maxilla, which is clearly defined from both by sutures. In this it agrees with Owen's specimen and with the calf's skull of the American Museum, and the inference is that the surface relief of this portion of the frontal becomes reduced and eventually lost in older specimens, fusing with the occipital complex, that is the supraoccipital plus the parietal elements, between which amalgamation is early effected. Only in Owen's specimen and in the skull of the calf is there a patent suture partially intervening between parietal and supraoccipital, though in the calf its obolescent portion can be followed to the vertex as a slight inequality of the surface. Evidently therefore this extension of the frontal on the surface as well as the partial persistence of the lambdoid suture are evidences of immaturity. To them may perhaps be added the small size of the lateral surface of the maxilla, and possibly the relative shortness of the rostrum, for these are all characters in which these three skulls agree. The Japanese skull, however, shows individual peculiarities in the marked concavity of the supraoccipital, in which it stands close to de Blainville's. The condyle however is not prominent; the postorbital process is long and pointed; and the maxillo-malar suture is quite different, convex ventrad in the greater part of its extent, becoming concave at its two extremities. Correspondingly the malar is triangular rather than triradiate in lateral view.

The skull in the National Museum though possessed of teeth in the maxilla yet approaches the skulls hitherto considered quite as much as it does Owen's specimen. It has a slightly concave supraoccipital, a condyle of little prominence, a contracted temporal fossa. The frontal would seem to reach far up between occipital and maxilla; the rostrum is very short and the maxilla has a peculiarly narrow lateral surface. The maxillo-malar suture is V-shaped with no angular change of direction in its diverging arms.

The South African skull figured by Sclater has a short rostrum, a narrow lateral surface of maxilla, a malar directed ventrally without inclination caudad, a V-shaped maxillo-malar suture, an enlarged antorbital process, a flattish occipital. The frontal does not ascend high on the surface, the condyle projects but little.

Owen's specimen, it will be remembered, was considered to be of different genus by Gill. Its cranial characters were not his only reason for this opinion, though he attached importance to the shortness of the rostrum and the presence of teeth in the upper jaw, both of them characters which are shared with the skull in the National Museum. The ventral direction of the malar, noted both by Owen and Gill, is also present in the South African skull. The high ascent of the frontal is shared with Wall's specimen, the Japanese skull and that at Washington, the narrow lateral surface of the maxilla with the Japanese and African examples. The enlargement of the antorbital process is approached by this last skull and also by the adult of the American Museum. This leaves only the very round contour of the maxillary tuberosity, the S-shape of the maxillo-malar suture, and the convexity of the supraoccipital to characterize Owen's specimen in lateral view, and all three of these characters, while nowhere else attaining precisely this configuration, are subject to variation from skull to skull.

Norma verticalis.— This aspect of the skull has naturally attracted attention from the first. De Blainville described the great transverse crest,[1] but curiously enough failed to mention the equally striking sagittal crest between the nares and the vertex. Gray [2] also is at first silent on this point. In the second edition of his catalogue he copies de Blainville's plate and here the crest is prominent enough, only Gray prints it reversed. The skull is excellently represented by van Beneden and Gervais as far as its deficiencies permit. Meanwhile Wall (1851) was led by the silence of Gray to form a new genus for his specimen, believing that so marked a character as the sagittal crest could not be overlooked if present. Wall correctly described the composition of the crest and described the right premaxilla as extending to the vertex, the left terminating in the wall of the nostril. Gray,[3] however, in 1866, aware of the condition of affairs in the Paris specimen rejects the new genus of Wall, whose work, on the statement of Krefft, he attributes to Mackleay, and lists the Australian animal as a new species of *Kogia*, in part because of the truncated extremity of the rostrum. Wall had described it as "truncated, slightly reflexed and marginate at the extremity." In all of which respects it agrees with the Paris skull as represented by van Beneden and Gervais. Later Gray [4] restored the genus *Euphysetes*, founded on Wall's individual, and characterized it by the simplicity of its sagittal facial crest as contrasted with *Kogia* of which the Paris skull is the type. This is now endowed with a "crest very sinuous folded so as to form a funnel-shaped cavity." It is true that the crest of the Paris skull is more convex to the left than Wall represents it to be in his skull, but to only a moderate degree, and it is difficult to imagine what is meant by the funnel-shaped cavity. Certainly there are no differences in this feature of the two skulls that could not be attributed to age or individual development.

---

[1] Crêtes frontales. They form the cirque faciale of van Beneden and Gervais.

[2] Gray, J. E. Erebus and Terror, 1846. Catalogue of the specimens of Mammalia in the collection of the British Museum. Pt. I, Cetacea. London, 1850.

[3] Gray, J. E. Catalogue of Seals and Whales in the British Museum. London, 1866.

[4] Gray, J. E. Supplement to the Catalogue of Seals and Whales in the British Museum. London, 1871.

The crest in question is formed by the left maxilla, to the right side of which the right premaxilla is applied, without however reaching the summit of the crest till near the vertex. The rostral half is strongly convex to the left and the limit of variation in this direction is that of the Paris skull, although it but little exceeds Owen's specimen in this respect. This portion of the crest is highly elevated and overhangs slightly the fossa of the left maxilla. The caudal half of the crest tends to be convex to the right. It is perceptibly so in Wall's, Owen's and the Paris skulls; hardly present in the American Museum specimen, it produces a marked narrowing of the right maxillary fossa in the individual of the National Museum. This is due to the development of the tuberosity of the premaxilla, prominent in all skulls of *Kogia,* into a longitudinal crest which reaches the vertex beside the left maxillary crest, a distinct groove intervening between them. In the lengthening of the tuberosity into a crest the Japanese skull shows an approach to the conditions attained in the Washington specimen. The tubercle of the premaxilla is variable; in the skull of the calf it is a moderate pyramidal elevation and to judge by the concavity behind it, corresponds only to the rostral portion of the ridge of older skulls.

The crest on the left maxilla may be continued between the nares by extensive ossification in the ethmoid; proximad and applied to the termination of the maxillary crest is a cylindrical spur projecting dorsally from the internarial septum. To this on the right is applied the postnarial process of the right premaxilla, which overlies and conceals a similarly placed but smaller spur of the ethmoid on the right side. These solid masses of bone appear to represent the lateral ethmoids, and their position and relations are clear in the skull of the calf. The one on the left side is continuous with the mesethmoid, here deflected to the left and is only partially separated from it by a V-shaped notch dorsally. In the adult skull the notch is largely filled up, only a small foramen and a slight incisure of the border of the internarial septum serving to indicate its position. In the skull of the National Museum there is no remnant of a notch; the internarial septum is very high, the postnarial process of the right premaxilla is strongly developed. If these characters may serve as an index of age they suggest again the immaturity of Owen's specimen, for there is a wide notch between the septum and the maxillary crest and the postnarial process though long is very slender. On the other hand in the Japanese skull the internarial septum is completely ossified and shows no sign of notch or foramen, yet this skull has other characters which seemed to indicate its immaturity.

The antorbital notch also varies somewhat. In Wall's skull and in the two belonging to the American Museum it is deep, narrow at its fundus and obliquely directed. In the skull of the National Museum and in that of Owen, it is more nearly sagittal, less deep, and somewhat broader at its deepest part. The last two skulls are relatively short, are very broad between their maxillary tuberosities, and the crest between them and the vertex approaches nearly the form of a semicircle. The Japanese skull while sharing these characters has yet a very deep, narrow and sagitally directed notch, which seems to show that the form and character of the antorbital notch is determined more by local variations in the bordering processes of the maxilla than by the general proportions of rostrum and brain-case.

Norma basalis.— The general contour is irregularly pentagonal. The greatest breadth is between the postorbital processes, while the strongly projecting zygomatic processes of the squamosal interrupt the outline between malar and tympano-mastoid. Extending from the antorbital notch to the otocranial plate of the occipital on each side a series of elevations divide a median region from the enormous lateral fossæ, which correspond in a general way to orbit, zygomatic and sphenomaxillary fossæ of less modified skulls. In the roof of this region appear portions of the maxilla, malar, lachrymal, frontal, orbito-sphenoid in part covered by a lateral projection of pterygoid, alisphenoid, squamosal and tympanic. In the maxilla near its caudal boundary is the large orifice of the infraorbital canal, and mesal and somewhat more caudally at the junction of the maxilla, pterygoid and frontal is the naso-palatine foramen. The sphenoidal fissure, optic foramen and foramen rotundum are confluent in the skull of the calf; in that of the adult a narrow bar of bone separates the optic foramen from the sphenoidal fissure. From the ental extremity of this foraminal complex a groove runs forward sagitally towards the infraorbital canal between the lateral process of the pterygoid and the orbito-sphenoid, which from its direction may serve to lodge the superior maxillary nerve. The foramen ovale opens near the suture between the alisphenoid and the squamosal, being prolonged a short way on the latter bone by a groove. The small ectal orifice of the canal for the carotid artery is some distance mesad of the foramen ovale close to the suture with the pterygoid. From it a shallow groove runs caudad and laterad to the extremity of the alisphenoid that rests against the basioccipital. This orifice and groove in the calf's skull are clearly seen to lie in a triangular plate-like extension of the sphenoid which is probably the processus ali-cochlearis. Laterad the processus ali-cochlearis is limited by a narrow fissure which on the surface runs to the foramen ovale and deeply extends to the secondary internal auditory meatus. In the skull of the calf there is a small foramen near the middle of the triangular area between the processus ali-cochlearis and the groove for the inferior maxillary nerve. The foramen leads entally into a canal which joins the foramen ovale. The suggestion lies near at hand that it is equivalent to the foramen spinosum. It is prolonged by a groove to the margin of the bone which would if the foregoing supposition is correct lodge the meningeal branch of the internal maxillary artery. Mesal to the groove a fissure runs caudo-laterad from the foramen to the margin of the bone and extends deeply to the secondary internal auditory canal. In the adult the configuration of this region is altered by the development of a plate-like extension from the margin of the squamosal which extends to the fissure just described and almost reaches the foramen ovale. In consequence the presumptive foramen spinosum and its arterial groove are concealed in the adult skull.

The median region of the base is included between the great flanges of the occipital (otocranial processes of Owen) and the pterygoids. It narrows rapidly rostrad and comes to be partially closed in by the inflected portions of the pterygoids. Caudal to the tubal notch the margins of these bones are still inflected throughout almost their whole length. In this inversion of the edge as well as in the general ectally concave sweep of the pterygoid as seen in the basal view, the skull of the American Museum differs from the other skulls available for comparison — de Blainville's, Wall's, Owen's, the Japanese and the one in the National Museum. In all of these the pterygoid is straight between the tubal notch and the occipital flange and the included median area of the base is therefore broader relatively to its length. In none of them is the free margin of the pterygoid inverted. The fissure between the basisphenoid and the presphenoid is still open but largely covered by thin scale-like extensions from the alæ of the vomer. These all but meet in the median line and largely conceal the presphenoid.

The rostrum is deeply emarginate at the tip, the sides of the notch being formed by the premaxillæ, small areas of which are interposed between the tip of the vomer and the maxilla (Wall). These latter send thin plates mesad beneath the vomer concealing it more and more towards the base of the rostrum. Upon the development of these thin plates depends the degree of exposure of the vomer in the palate. In Owen's specimen the vomer presents a wide surface between the maxillæ, wider than in any of the other *Kogia* skulls of which the basal view is available for comparison.

In this as in the dimensions of the alveolar sulcus, the widely open basisphenoid-presphenoid fissure unconcealed by extensions of the vomer, the extent of the gap between the pterygoids and the slender form of their hamular processes, Owen's specimen would seem relatively immature, although it was with young when captured. In all of the characters enumerated, except the degree of exposure of the vomer, the Japanese skull closely resembles the one described by Owen.

The pterygoids send a process obliquely rostrad across the palate bone to reach the maxilla. In consequence the palate has two separate areas of exposure between pterygoid and maxilla. The one in the front is semilunar and in contact with the opposite bone at the midline of the palate. The other area is small, subcircular and laterally placed, corresponding to the latero-caudal extremity of the palate bone. The process of pterygoid which thus crosses the palate was very delicate and fragile in the calf. It touched the maxilla but was not ankylosed to it and the palate bone had slid out from beneath and was lost. In the adult the process is broad, strong and firmly united with adjacent bones by suture. In the basal view of the skull of *Kogia* these processes seem as a rule to be imperfect or broken and a correspondingly large area of the palate is represented as exposed. The Japanese specimen in which these pterygoid processes are preserved is intermediate between the two skulls of the American Museum in respect to their size, and the lateral exposed area of the palate bone varies correspondingly.

Norma occipitalis.— This surface attains its greatest breadth between the exoccipitals at the angle in which they terminate against the squamosals. These angles are usually rounded or truncated, but in Owen's specimen produced so that they all but totally conceal the zygomatic process from behind. The junction of the exoccipital with the basioccipital is marked in the margin by a deep incisure. From this a ridge ascends a short distance towards the condyle. This marks the junction between basi- and exoccipital as is shown by an accompanying small sutural remnant in the skull of the calf. Corresponding to it there is a small projection towards the incisure partially subdividing the latter into upper and lower compartments. This is clearly defined only in the skull of the calf. From the summit of the jugular incisure a groove ascends nearly half way to the condyle terminating in a foramen, the hypoglossal canal. The dorsal border of the exoccipital ascends as far as the upper limit of the temporal fossa from which it is separated by a narrow strip of squamosal. Here may be detected a remnant of the lambdoid suture continuing the general direction of the border of the exoccipital towards the transverse crest. In the skull of the calf its all but obliterated remains are discernible as far as the vertex where it reaches the apex of the crest. The parietal thus delimited from supraoccipital extends from the supra-temporal ridge to vertex. In the temporal fossa it is concealed by the squama and is here reduced to a paper-thin reticulum of bone which in the cranial cavity occupies the interval between frontal, exoccipital, alisphenoid and an extensive secondary ossification of the tentorium. On the surface the parietal has a moderate breadth above the temporal fossa, its convex rostral border participating in the transverse crest and tending to override and fuse with the frontal in older skulls as has already been described. Like the frontal it runs out towards the vertex in a narrow strip which, soon fused with the supraoccipital, all but loses its identity. Of the interparietal there is no trace on the surface. In the skull of the calf it seems in a greatly reduced condition to have fused with the right frontal (*vide infra*).

The contour of the skull in occipital view varies most towards the vertex. In Owen's specimen it is evenly but flatly arched between the parietals. In de Blainville's and Wall's examples it falls off somewhat towards the sides but is still broad and flat, while both skulls of the American Museum agree in greater steepness at the sides and a bluntly pointed vertex. Both have a median concavity in the supraoccipital bounded by lateral convexities, all of which are more developed in the adult.

Mandible.— The lower jaw consists of a tooth bearing portion of moderate strength and an expanded papyraceous portion opened in its whole length by the enormous inferior dental foramen. In this region a frame of thicker bone forms the borders and the remainder is reduced almost to the thinness of paper and is of great fragility. The caudal margin is supported by a crescent of stronger bone attaining its maximum breadth at the ill defined condyle and its horns becoming continuous with the upper and lower borders of the bone. These gradually become raised on the ental surface into ridges which increase rostrad in height and eventually form an inner wall for the dental canal in the alveolar portion of the jaw. Opposite the point of closure the dorsal margin of the bone rises into a flat somewhat everted tubercle, just rostrad of which the dental sulcus begins. This occupies the lateral, not the upper surface of the jaw. It is widely open and imperfectly divided into separate sockets for the teeth which are twelve in number on each side in this adult. For somewhat more than half the length of the alveolar sulcus, the mandibles are united by a symphysis. This involves the lower margins only projecting as a keel ventrad, while above a deep sulcus separates the bones. This mandible differs from others of *Kogia,* so far as can be judged from illustrations, in its slenderness. On account of the great divergence of the rami, however, lateral views are not altogether satisfactory as it is impossible to gauge the degree of foreshortening.

Gill has laid stress on the fact that Owen's specimen differed from other *Kogiæ* in its rounded, almost semicircular proximal extremity. This peculiarity Owen himself describes. Wall characterized this region of the mandible also as semicircular, yet in his illustration the bone differs widely from Owen's and has distinct though rounded angulation at the junction of ventral and caudal margins. This indication of the angle is present in all other *Kogia* mandibles and is perhaps most pronounced in the specimen in the National Museum. This jaw is also peculiar in that its dorsal margin forms a straight line in its whole length. In the adult skull of the American Museum, the postalveolar tubercle separates two well marked concavities in the outline. The Japanese specimen shows an approach to this contour. In the calf, however, the upper border is nearly straight and the angular region well marked, which suggests that these are juvenile characters.

Teeth.— The presence of teeth in the upper jaw has been recorded in three individuals. In Owen's there was one on each side in the maxilla. In the skull of the National Museum each maxilla contains two teeth. Finally Benham describes teeth, one on each side, not contained in the bones of the rostrum but in a 'sclerite' of calcified cartilage. This was situated in front of the premaxilla but separate from it and was grooved ventrally, the depression being continuous with the alveolar sulcus of the maxilla. This singular observation is in need of confirmation, and Benham appears to be mistaken in associating the absence of teeth with the loss of the sclerite, for in two cases they have been observed implanted in the maxillary and the regular persistence of the alveolar sulcus, sometimes with imperfect formation of sockets, implies the retention of teeth to a late period of fœtal life. Their existence in the adult is an individual and not a sexual peculiarity, for Owen's specimen was a female, Benham's a male.

The mandibular teeth, long, curved, slender and lacking enamel, are variable in number and curvature, those at the caudal end of the series being often closer set and with their points directed towards the angle of the mouth. The usual number is thirteen. The least number is that recorded by Owen, nine, which is the same as in Sclater's Greenpoint specimen. Both of these were females and of small size. In the calf skull in the American Museum, the mandible has nine imperfectly formed sockets in the alveolar sulcus on each side. A skull in the British Museum has 14–15 (Beddard), one at Napier fifteen (Benham). The adult of the American Museum has twelve. It would seem probable that this variation may in part depend upon age and that teeth continue to erupt after the animal has attained adult size. Apparently the caudal members of the series are in the process of reduction.

The nares.— The left nostril is oval and in general smooth walled, expanding towards the surface of the head chiefly in the sagittal direction. Caudad it is demarcated from the concavity of the face by a distinct but rounded ridge of the maxilla; rostrad on the premaxilla it has no distinct boundary. A full half of its contour is formed by the maxilla overlayed laterad and in front by the thin scale-like termination of the premaxilla. From below the pterygoid ascends to meet the maxilla and like it forms about one-half of the wall of the passage. When these bones of the calf are articulated a moderate interval is left between them rostrad which must have been occupied by the edge of the palate bone. In the adult the interval is narrowed but a thin strip of palate still appears in the rostro-lateral quadrant of the narial passage. The mesal wall is formed by the mesethmoid, left ectethmoid and ventrally the vomer. In the posterior wall in the gap between pterygoid and maxilla on the one hand, vomer and mesethmoid on the other, is a shallow depression in which appears the lateral ethmoid with the foramen for the nasal nerve. In the suture between maxilla and pterygoid is the orifice of a small canal leading from sphenomaxillary fossa and probably transmitting filaments from the sphenopalatine ganglion.

The right nasal passage at its orifice is bounded by the premaxilla except mesad where the internarial septum is formed by the mesethmoid and left ectethmoid. Deeper in the passage the tuberosity of the vomer forms the rostral and part of the lateral boundary; the exposed maxillary area is much reduced and has the shape of an L reversed, the horizontal arm turning forward between the pterygoid and the tuberosity of the vomer. Near the middle of the horizontal portion of this surface is the orifice of the canal from the spheno-maxillary fossa. Rostrad of the canal the surface of the maxillary is depressed in a small fossa between the pterygoid and the vomer and here, largely covered by the pterygoid, a narrow edge of palate comes into view. Caudal to the maxilla is a second small recess corresponding to that of the right side and closed by the lateral ethmoid with the foramen for the nasal nerve.

Foramina.— Of the foramina for the cranial nerves those of the olfactory appear to be lacking. The foramen between mesethmoid and ectethmoid which leads rostrad into the nasal fossa it seems preferable to interpret as conducting the nasal nerve until evidence of the existence of an olfactorius is forthcoming. For the entrance of this nerve into the cranial cavity there are possible paths in one or other of the small foramina of the orbital plate of the frontal or in the incompletely ossified fissure between that element and the presphenoid.

The optic foramen is confluent with the sphenoidal fissure in the skull of the calf. In the adult it is on both sides separated by a very tenuous osseous lamella. In view of its late ossification the metoptic process would seem to be on the verge of disappearance.

The sphenoidal fissure is closed mesad by a process of the pterygoid and lateral a portion of frontal intervenes between the extremities of the orbitosphenoid and ala temporalis.

The foramen rotundum is confluent with the sphenoidal fissure so widely that it is represented only by a concavity in the margin of the ala temporalis.

The foramen ovale is directed obliquely through the ala temporalis. Its ectal orifice is prolonged laterad into a groove.

The combined jugulo-acoustic canal is bordered caudad by the exoccipital, ventrad by the union of that element with the flange of the basioccipital, the ectal portion of the suture persisting; dorsad the boundary is given by the exoccipital. Rostrad a process of this bone meets the alisphenoid. The portion of the greater wing which here participates is fissured in the whole length of the canal and thus appears divided into two parts. In the cranial cavity the fissure intervenes between the greater wing and a mass of bone which from its position appears to be an ossification of the tentorium. The suggestion is therefore plausible that the lateral of the two parts is a secondary membranous ossification. The cranial orifice of this canal is funnel-shaped bounded rostrad by a sharp ridge composed of the tentorial ossification and the greater wing.

The hypoglossal foramen begins in the caudal wall of this funnel and opens ectally on the caudal surface of the exoccipital near the notch which separates this element from the flange of the basioccipital.

The canal for the carotid artery is of very small size, the chief arterial supply of the brain being no doubt as in other whales by way of the vertebrals. The canal begins as a groove upon the ali-cochlearis and disappears from view in the articulated skull beneath the pterygoid. It pierces the ala temporalis, appearing in the cranial cavity mesal to the foramen ovale at the side of the basisphenoid.

Smaller vascular foramina lie in the fronto-maxillary suture and are continued into canals on the cerebral surface of the maxilla. A small foramen pierces the alisphenoid caudo-lateral to the foramen ovale and joins that canal close to its ental orifice. Just caudal to that orifice a minute canal leads into the fissure between the processus ali-cochlearis and basioccipital.

The cranium of *Kogia* appears from the foregoing compilation to be subject to a considerable degree of fluctuating variation. With the data at present available it is impossible I feel to distinguish sexual characters, for Sclater's inference that the long mandible and implicitly the long rostrum belong to the male appears invalidated by the fact that these characters are highly developed in the adult of the American Museum which is a female.

On the other hand it is possible tentatively to assign certain characters to the period of immaturity and the following list indicates such peculiarities as are common to the calf of the American Museum and the smaller specimens that are recorded in the literature:

The visible extension of the frontal towards the vertex.

The partial persistence of the parieto-occipital suture.

The sinuous form of the maxillo-malar suture.

The incomplete synostosis of the mesethmoid and left ectethmoid.

The less development of the mid-facial crest and of the tubercle of the right premaxilla.

The tenuity of the infrapalatine processes of the pterygoids.

In the calf alone may further be observed a persistence on one side of the suture between the lachrymal and malar, a confluence of the optic foramen with the sphenoidal fissure, and a faint trace of the compound nature of the pterygoid. The comparison of the calf with the adult female shows further a tendency in maturity to develop free borders into over-riding plates of bone, *e. g.*, from the squamosal upon the alisphenoid, from the maxillaries beneath the vomer and from the orbital plate upon the lachrymal.

Architecture.— The elements of the rostrum are joined to one another by broad simple surfaces of contact, only as the nasal region is approached are interlocking processes and ledges developed. The robust mesethmoid and septal cartilage form a stout axial support to the center of which is applied the strong trough of the vomer. Upon the sides of this axis abut the maxillaries and premaxillaries, the former sending forth a shelf beneath the vomer on each side, the latter at least at the base of the rostrum tending to overlay the vomer and mesethmoid dorsally with a plate produced from their mesal margins to a degree which increases slightly with age. All the sutures between these elements persist in the skull of the adult. This simple apposition of the several elements seems to stand in relation to the shortness and breadth of the rostrum, sufficient rigidity being afforded by the bulk of the individual elements to resist stresses acting with so short a leverage, without the development of a more intimate union and welding together of the component parts.

When it comes to the connection of the rostrum with the cranium, simple contacts seems to be no longer adequate and surfaces of reciprocal reception with interlocking process are substituted. The major rôle in giving stability to this junction devolves upon the maxilla which in the Cetacea establishes intimate and extensive contact with the frontal, coming to override it dorsally and ventrally by supra- and infrafrontal processes. While a greater or less degree of dorsal overriding (suprafrontal process) is regularly present, the infrafrontal process is conspicuous only in Mystacetes. It may be present in a reduced condition however in Odontocetes, as for example, in these skulls of *Kogia*. When both processes are present as, *e. g.*, in *Balænoptera*, the frontal, in particular its orbital palate, comes to lie between two arms of the maxilla and receives the backward thrust of the rostrum as the beast moves through the water.

The pressure thus brought to bear upon the frontal is no doubt a factor in determining the lateral position of the orbit and from the need of additional support may serve to explain the enlargement caudad of the postorbital process to the point of fibrous contact with the squamosal.

Though the maxillaries with the right premaxilla thus provide firm support to the rostrum, auxiliary means of fixation are present in the mesethmoid and the two pterygoids. The mesethmoid, however, from its asymmetry and the thinning of its proximal portion by the enlargement of the left nasal passage, can be looked upon as possessing but moderate strength, while the alæ of the vomer are so thin that no real mechanical importance can be attached to them. The pterygoids, extending obliquely from the maxillæ to the stout flanges of the basioccipital, are moderately thick plates projecting ventrally from the skull and so placed as to serve as a brace to the moderate angle formed by the facial and basicranial axes. As it approaches the maxilla, however, the pterygoid becomes greatly reduced in height and expands laterad into a thin plate. Its surface of articulation with the maxillary is but small and that for the palate though wide is not characterized by strong ridges. It would seem therefore that though bracing the rostrum against displacement ventrad and serving also to attach it to the brain case it could hardly be called upon to resist forces of great magnitude in either a transverse or dorso-ventral direction. The latter displacement would seem rather to be provided against by the mesethmoid and in the dorsal direction in addition by the ventral overlapping of the vomer on the part of the maxillaries. Even so, the conformation of the fronto-maxillary articular surfaces and the diminished thickness of the mesethmoid proximad suggest no great demands for support, a supposition borne out by the lightness of the structure of the mandible and the very moderate size of the temporal fossa.

It would seem warranted to conclude therefore that the chief mechanical factor in determining the nature of the attachment of the rostrum to the cranium in *Kogia* is resistance to the pressure of the medium through which the animal moves. The shortness of the rostrum, notwithstanding its breadth, coupled with the delicacy of the lower jaws, would seem to render special provision against dorsal deflection superfluous.

The architecture of the cranium is dominated by the great transverse crest extending between the orbital roofs. While the core of this is, as might be expected, formed by the frontal, yet this bone is compressed to a paper thin plate between the massive maxillaries and the supraoccipital. There seems to be a reduced interparietal at the vertex, but the parietals have here lost their independence in the calf as well as in the adult. The surfaces of apposition are very broad and the crest forms an arch of massive bone which in section would have slight rostro-caudal extent, but on the other hand a very considerable depth. Traced to the sides it expands into a triangle of thick bone extending rostrad to the orbital plates and caudad including the tip of the alisphenoid, the squamosal and portion of the exoccipital. It thus corresponds in general to the anterior and posterior pillars of the vault with a thickening of the intervening junction of lateral wall and floor of the cranium as compared with other mammals. The sagittal line here indicated is reinforced in Cetacea by the fibrous contact between the postorbital process and the zygomatic process of the squamosal.

In comparison with the transverse arch and its lateral abutments thus enumerated, the remainder of the brain case is less massive, though its rostral wall composed of the maxillaries reinforced by the right premaxilla and the strong facial crest fall but little short of the arcade and far exceed the other parts of the cranium in thickness.

The remaining thickened areas can be briefly enumerated. A ring of thick bone supporting the condyles surrounds the foramen magnum; from this a narrow zone of relatively massive bone extends laterally through the exoccipitals to reach the caudal angles of the triangular lateral thickenings, and a sagittal one reinforces the midline of the supraoccipital reaching the vertex. These all project entad but are apparent on holding the skull to the light.

The elements of the basicranial axis are not conspicuous for their strength but are broad and of only moderate thickness, in fact, on each side of the median line they are translucent when held to the light. As a whole this region does not seem qualified to play more than a subordinate part in supporting the thrust of the spine against the cranium as the animal propels itself with its flukes. Indeed the high position of the condyles and their extension dorsad far above the level of the basicranial axis would preclude the supposition that this force could act directly through the axis. The architecture seems rather to indicate its resolution along the ridges above described, mesally to the transverse crest at the vertex and sidewise to the ends of its lateral expansions. The large proportion of the thrust thus supported may account for the lack of robustness in the elements of the basicranial axis, especially when it is borne in mind that additional bracing is provided ventrally by the articulation of the pterygoids with strong flanges of the basioccipital.

The Cranial Bones.

The cranium of the calf permitted of partial disarticulation. The bones of the rostrum were readily removed as were also the pterygoids, malars and tympanics. One squamosal also was loose and was isolated. The remainder comprising the greater part of the cranial wall was firmly united and many of the sutures were partially or completely obliterated.

The skull is in generally good preservation, although the bones are extremely brittle and some of the processes are broken at their tips. Both palate bones and both periotics are missing as is also the left premaxilla, but its extent is easily determined by its impression upon the maxilla.

The dimensions of this skull have already been given in the comparative table and its salient peculiarities of form have been noted in the description of the skull as a whole. In what follows it is purposed to confine attention to the individual elements in so far as they can be isolated or their extent ascertained.

Occipital.— The several elements of this bone are already firmly united, and in addition the parietals are fused to the supraoccipital and the suture between the basisphenoid and basioccipital has been obliterated. No trace of that between supra- and exoccipitals can be discerned. Ventrally a notch intervenes between the otocranial flange of the basioccipital and the exoccipital and here a small remnant of the suture between these elements persists; a low ridge prolonged towards the condyle seems to mark the obliterated portion of the suture. The condyles are elevated a little above the adjacent surface, are rather narrow, their broader ventral ends are separated by a distinct groove. The greatest breadth lies opposite the slight angulation of the mesal border at the level of the ventral margin of the foramen magnum. Here the right measures 24 mm., the left 27 mm. The right condyle on the other hand is somewhat longer, 69 mm. as against 67 mm. for the left. The foramen magnum also is slightly asymmetrical being distinctly more convex to the right. Its sagittal diameter is 42 mm., its maximum transverse is 38 mm.

Basisphenoid.— The basisphenoid is short and very broad and has already coalesced with the alisphenoids and basioccipital. Entally its union with the latter is marked by an elevated ridge just in front of which at the sides are the orifices of the basisphenoidal canals. The surface in front of the ridge is concave sagittally, convex from side to side. In the midline there are a few vascular foramina and a small conical tubercle (dorsum sellæ). Ectally the surface is flat and broadens caudad to the basioccipital. The median area is smooth. At the sides where the greater wings arise, are rough triangular areas for the pterygoids, mesal to which a thin, high lamella of bone prolongs the flange of the occipital.

Alisphenoid.— The greater wings are of large size expanding laterad as far as the infratemporal crest and caudad to the jugulo-acoustic canal. The ectal surface beyond the pterygoid area just mentioned is free. Rostrad it is limited by the orbital fissure and the sphenofrontal suture. A broad scallop in its fissural margin represent the foramen rotundum. From the infratemporal crest to the caudal angle extends the spheno-squamous suture. Close to the infratemporal crest the alisphenoid is thin and, drawn out into a triangular plate, overlies the frontal as well as the squamosal. In the rest of the suture the bone abruptly thickens and rests against the squamosal with broad surfaces of apposition which are almost smooth.

Presphenoid.— This is fused with the ethmoid and vomer but free from the orbito-sphenoids. The basal surface is all but concealed by the first mentioned elements. The cranial surface is hexagonal and marked by a low median ridge between shallow concavities. The rostral border is fused with the ethmoid, as has been already stated; faint traces of the suture persist running laterad from the nasal foramina. The rostro-lateral margin articulates with the frontal, the caudo-lateral with the orbito-sphenoid. The caudad border is pitted for cartilage, the fissure between this bone and the basisphenoid being still open. Ventrally the pterygoid covers the presphenoid at the sides in its whole length and sends a process into the cleft between it and the basisphenoid which forms the mesal closure of the sphenoidal fissure.

Orbito-sphenoid.— The ala-orbitalis occupies the mesal portion of the groove in the orbital plate of the frontal. It is fused with this so completely that on the cranial surface its outlines are lost. In the orbit its contour is just perceptible, following the ridge in front of the frontal groove and then arching across the concavity to the end of the sphenoidal fissure. Where it forms the boundary of the fissure it is marked by a deep notch, the optic foramen, from which a groove runs laterad on the orbital surface, a second mesad on the cranial. From the ridge which bounds the former groove mesad, the whole surface of the orbito-sphenoid is covered ventrally by the pterygoid.

Ethmoid.— The mesethmoid occupies the trough of the vomer and is correspondingly broad ventrad and contracted dorsad. In cross-section it is ovoid coming to a point above and strongly concave on the left side. Its rostral extremity, rough and pitted for the attachment of the septal cartilage, lies opposite the prenarial tubercle of the left side. The mesethmoid becomes much thinner where it forms the internarial septum and here it is deflected to the right, strongly in its ventral portion, hardly at all near its dorsal margin, so that it comes to form an oblique wall between the nares. Caudally it is fused with the presphenoid. The junction is covered at the sides by the alæ of the vomer, also syostotic, but even ventrad where it is exposed by the gap in the vomer no trace of the union can be made out with certainty.

Attached to the dorsal edge of the mesethmoid is an irregular mass of bone which is apparently representative of the lateral ethmoids. Towards the cranial cavity it presents a triangular surface marked off from the presphenoid by a pair of foramina and lateral to them the remnants of sutures; a faint transverse groove connects the foramina. Their ectal orifices are in the nasal fossa close to the dorsal margins of the alæ vomeris, that of the right side distinctly on a more ventral level than the left. The dorsal surface of this ethmoidal mass is rough and irregular. Rostrad it is drawn out into two processes of very unequal size. That on the left is the larger and intervenes in the articulated skull between the narial septum and the extremity of the crest of the left maxilla, being separated from the former by a notch, which in the adult skull is partly closed to a foramen. Its left surface appears in the narial passage and overhangs the orifice of the canal for the nasal nerve. Its right surface is partly covered by its apposition to the postnarial projection of the right premaxilla, in front of which it appears in the mesal wall of the right nostril. The right process is much smaller and depressed ventrad. It enters into the right nasal fossa forming a portion of its caudal wall above the foramen for the nasal nerve. Laterally it articulates with the right maxilla and dorsally is concealed by the postnasal projection of the right premaxillary. These two asymmetrical projections, on account of their relation to the nasal fossæ and to the mesethmoid as well as to the canal for the nasal nerve, are to be interpreted as lateral ethmoids. The area caudal to the right ectethmoid and the rough triangle in which this dorsal surface terminates are covered by the right maxilla which leaves an oval rough facette exposed immediately caudal to the left ectethmoid. This is covered in the articulated skull by the premaxilla.

Nasal bones.— Owen describes these elements as confluent with the midfacial crest. In this he is probably in error, for in all Odontocetes they are displaced toward the vertex. Influenced by conditions in *Physeter,* Wall believed he detected evidences of a scale-like left nasal applied to the surface of the maxillary. Other authors are silent on this matter. In neither of the skulls of the American Museum is there a trace of either nasal bone.

The vomer.— The trough is broad to accommodate the thick septal cartilage; it enlarges slightly to its terminal quarter and then contracts again towards the tip of the rostrum. Its sides ascend well upon the cartilage, attain considerable thickness proximad and terminate in conical prenarial processes on reaching the confines of the nasal fossæ. These projections are markedly asymmetrical in correspondence to the disparity in size of the nasal passages. That of the left side points laterad at the level of the end of the mesethmoid; the large one on the right is directed caudad and is received in an excavation of the maxillary close to the junction of its rostral and frontal portions. Ventrally the vomer has an axial ridge which terminates caudad in a small elevation concealed in the natural condition of the skull by the palate bones. The ridge however is exposed in the palate, for the maxillaries do not meet here though close together at the point where they are overlapped by the palate bones. Because of the concavity of the borders of the maxillaries, the exposed surface of the vomer has the shape of a narrow oval; this in the calf attains its greatest width in the middle of the rostrum and not in its terminal third as in the adult where its contours also are more angular. Both the medial ridge and elevation of the vomer are faintly grooved. In reference to this ridge, which coincides with the midline of the skull, the vomer is markedly asymmetrical, the width of its left side being approximately half that of the right. Caudal to the elevation in which the ridge terminates the vomer becomes thin and scale-like and following the deviation of the mesethmoid turns to the right and divides into the enormous alæ. These are very thin and at first embrace the sides of the mesethmoid entering into the mesal walls of the nasal passages, they then rotate through 90° and extend as far as the basisphenoid-presphenoid fissure. In the adult they extend farther unlying the basisphenoid with a thin irregular scale of bone. Where they are applied to the presphenoid they are broad and extend far laterad; on the right side a contact is formed with the frontal, on the left a very narrow strip of presphenoid intervenes. While synostosis has already begun between the vomer and the bones of the axis on the left side, it is still possible to follow the contours of the ala in its entirety, on the right its outline is lost in the nasal fossa though retained caudally. On account of the depth of the notch between the alæ, the mesethmoid is exposed ventrally in its internarial portion.

The premaxilla.— The left premaxilla was lacking in the younger skull, save fortunately its narial extremity, a thin scale of bone adhering to the maxilla in the lateral wall of the nostril. The area of its contact with the maxilla could be recognized by the character of the surface of the latter bone.

The right premaxilla is divided by the notch of the naris into a rostral and a frontal portion. The former is curved and its dorsal surface is more tapering than in the older skull; its lateral margin as yet lacks the somewhat angular change of direction in its terminal fourth. A short distance in front of the nostril it presents the orifice of a canal leading from the spheno-maxillary fossa. The lateral margin at the level of the nostril takes part to a minimal degree in forming the wall of a larger canal leading from the same fossa. In the older skull the premaxilla forms nearly a half of the circumference of this foramen, which coupled with the more vertical course of the canal, may indicate relative expansion during growth of this portion of the premaxilla. The ventral surface near its lateral margin presents the orifice of the first of the above mentioned canals, and from this point rostrad is marked by a high strong ridge or projecting plate which is fitted into the interval between the maxilla and the vomer. The terminal portion of this ridge appears as a linear strip on the palatine surface of the rostrum; its subsequent expansion at this point being as yet barely indicated. Lateral to the ridge the surface rests against the maxilla; the surface mesal to it forms with that bone a sagittal concavity which is occupied by the vomer, exception made of two small areas adjacent to the nares. Here the ventral portion is overlapped by a plate arising from the pterygoid, while dorsally a blunt projection forming the rostral boundary of the reduced nostril rests against the mesethmoid.

The frontal process is transversely expanded and prolonged to the summit of a great crest which marks the vertex of the cranium. Near the vertex in the adult the bone is narrowed to a tongue-like process; here it is shorter and broadens gradually into the remainder of the bone. Laterally at the junction of the middle and first thirds near the margin is a low triangular eminence, other than which there is as yet no evidence of the subsequent marked elevation of this margin. Mesally the border rises in a moderate crest, which rests against and is over-topped by a similar sagittal elevation of the left maxilla. The surface turned toward the latter bone is marked by a longitudinal groove which receives a ledge of the left maxillary. Ventral to this the maxillary has a flange which fits into the interval between the premaxillary and the maxilla of the right side. The junction of the bones along the facial crest is by a series of interlocking projections as though this region of the skull had to withstand stress which from the direction of the structures in question would seem to be chiefly in a direction at right angles to the surface. Ventrally the frontal process of the right premaxilla rests broadly upon the maxilla of the same side, towards the median line overlapping that of the left side. Just behind the nostril a process crosses the median line and by its deep surface articulates with the coalesced ethmoidal rudiments.

The maxilla.— The maxillaries, like the right premaxilla, are conveniently divided into rostral and frontal portions, the demarcation afforded by the nasal fossæ and the very deep antorbital notches. Both portions differ markedly on the two sides. The bone of the right will serve throughout as a basis of description, the peculiarities of the left being summarized at the end.

The rostral portion is exposed in about half its breadth. This surface is concave in front of the infraorbital canals; behind them it rises in a broad ridge which forms the median margin of the antorbital notch and presents caudally the orifice of a large canal leading from the infraorbital fossa. The elevation of the lateral margin is inconsiderable, save that the process in front of the antorbital notch is well developed and has about the same configuration as in the adult. The remainder of the dorsum of the rostral portion articulates with the premaxilla and the vomer. A ridge intervenes between their respective areas and becoming high and jagged towards the base of the rostrum passes into the frontal portion of the bone.

This latter is deeply concave, the greatest depression corresponding with the ridge between the frontal surface and lachrymal areas of the ventral surface. Mesad there is the broad rough surface of contact with the premaxilla, convex near the midline but becoming concave laterad where it lodges the expanded part of the premaxillary. Here a sharp ridge limits the articular surface and separates it from the exposed area of the pars frontalis.

The mesal border articulates with the left maxillary. It is thick, rough and convex, and is received in a slight groove in the border of the left bone. The intermaxillary contact extends from the vertex forward to a quadrangular plate on the right side, which projects strongly to the left crossing the midline and intervening between the left maxillary and the ethmoid. This is covered in the articulated bones by a process of the right premaxilla. In front of this the border rests against the ectethmoid, beyond which again is a small L-shaped area which enters the lateral wall of the nasal fossa. In the ventral part of this is a fissure which leads mesad from the region of the infraorbital canal. The rostral arm of the L extends upon the nasal side of the pterygoid elevation of the maxilla and on the right side comes to be largely overlapped by a scale of the pterygoid. Near its rostral extremity is the foramen of a canal leading from the infraorbital fossa. The orifice lies in a lozenge-shaped cleft between the maxilla, palate and vomer, forming a small lateral and rostral extension of the nasal fossa. It is present and slightly larger in the adult, but lacking altogether on the left side. From the foramen rostrad the margin is sharp. It is directed mesad as well as rostrad as far as the articular surface of the palate, whence it recedes more gradually towards the tip of the rostrum. Its most mesal point just fails of reaching the corresponding projection of the opposite maxillary. The lateral margin increases in thickness from the vertex to the antorbital notch, thence diminishing rostrad. The latter segment lacks as yet the upward rolling of the adult.

The left bone differs from the foregoing in the following particulars. In its rostral portion the subvomerine shelf is narrower. The ridge beside the antorbital notch is small and narrow. The surface of the bone is depressed to form a funnel shaped approach to the nasal fossa. Instead of forming a clearly defined L-shaped area as on the right, it extends ventrad to meet the pterygoid in a long suture in which appears rostrad a narrow edge of palate. The scale-like extremity of the premaxilla simply overlies the maxilla leaving the latter widely exposed in the nasal fossa below it. The concavity of the frontal process is increased by the high sagittal flange which participates in the facial crest, the right bone being excluded by the premaxillary. Finally on the ventral surface the ridge between the cerebral and lachrymal areas is less pronounced.

Ventrally only a triangle of the maxillary is exposed to form the bulk of the palatine surface of the rostrum. This differs only in detail from that of the adult; the alveolar gutter is relatively longer, the concavity mesal to it is shallower; the surface as a whole less extensive transversely and as yet lacks the rolled character of the free margin. This area is limited caudad by an arched line beginning at the most projecting point of the mesal border and extending to the antorbital notch, where it rises into a ridge-like process to articulate with the lachrymal. Caudal to the arched line, at the mesal margin is a triangle for articulation with the palate; this by its caudal apex is continuous with a roughened elevation for the pterygoid. Between the palate and pterygoid mesad and the lachrymal laterad is an exposed surface, less concave than in the adult, near the caudal limit of which appears the large orifice of the infraorbital canal. The mesal margin of this foramen is undermined and jutts out in a thin triangular lingula. Behind this, mesal to the foramen, the bone is marked by transverse sulci one of which deepening to a cleft leads into the nasal fossa. The infraorbital canal at its beginning is an ovoid fossa in the maxillary, considerably larger and deeper on the right than on the left side, from which smaller canals run rostrad and dorso-laterad, the former to open upon the rostral surface of the premaxilla (one) and maxilla (R. five, L. three), the latter (two) upon the frontal process of the maxilla. Of these latter on the right side one opens in the premaxillary-maxillary suture. The exposed surface caudal to the infraorbital canal is formed by a transverse elevation, the lateral extremity of which overrides the tip of the lachrymal and articulates with the frontal. Rostrad it bounds a foramen in the suture with the lachrymal, which was in the adult much the shape of the impression of a finger nail. In this suture are the beginnings of arterial sulci, one passing mesad and one caudad to reach the cranial cavity by way of the fronto-maxillary suture and to be continued as branched systems of grooves on the cerebral surface of the maxilla.

The remainder of the ventral surface consists of a cerebral surface entad and a broad marginal area for articulation with the malar, lachrymal and frontal. The area for the lachrymal extends from the transverse elevation behind the infraorbital canal to the depression for the conical process of the malar and behind this is prolonged nearly to the border of the bone. The surface for the malar extends from two concavities separated by a low obliquely transverse ridge to the antorbital notch and the lateral margin. The rounded rostral border of the lachrymal is received in a corresponding concavity of the maxillary mesal to the antorbital notch, and here between the notch and the infraorbital canal a scale-like plate of maxillary overlies the lachrymal. In the adult this has increased in size and is marked with ridges interlocking with similar ridges of the lachrymal. In the young skull they are absent on both bones. The tip of the lachrymal fits into a conical depression of the maxilla beneath the elevation immediately caudal to the infraorbital canal.

The surface for articulation with the frontal has two subdivisions; one overlying the orbital roof is relatively smooth and lies in the same plane as the area for the lachrymal. This surface is roughly triangular. The remaining surface of contact with the frontal is marked by parallel ridges which curve from the cranial cavity dorsad and laterad. As a whole this surface is convex latero-mesad. Sagittally it has a sinuous contour with a tendency to angulation at the point where the frontal becomes reduced to a narrow plate.

The cranial surface has a fairly developed vitreous and shows vascular channels directed from the sides horizontal with a marked ascent as they approach the midline. Here the surface is narrowed by the downward projection of the interparietal above and the area for the presphenoid and coalesced ethmoid below.

The malar.— Much uncertainty has prevailed regarding the margin of the orbit in *Kogia,* and in particular the nature of the closure of the gap between the zygomatic process and the extremity of the malar. This is grooved at its tip between two tuberosities and the surface might serve as well for articulation as for the attachment of a fibrous arch. It has therefore been open to question whether the jugal might not have disappeared and the element so named be really interpreted as lachrymal, or perhaps as lachrymal and malar, with the zygomatic process of the latter reduced to ligament. Le Danois has described and figured a fibrous infraorbital arcade, but this extended to the exoccipital and the condition of his specimen was far from favorable. In a dissection of a new born *Kogia,* this structure was found to be the facial nerve. On the other hand, a perfectly definite ligamentous arch was present connecting the tip of the malar to the zygomatic process of the squamosal. Very fortunately the skull of the calf on the left side has a separate malar and lachrymal, the latter mesal in position and interposed between the maxilla and the frontal. It is evident, therefore, that the usual elements are present but that the zygomatic process of the malar has been reduced so that it no longer appears as bone.

The malar is an irregular pyramid in form. If the lateral surface is taken as the base the three remaining surfaces are indicated in a general way by the direction of its borders. Instead of an apex however there is a notch between two conical processes which are received in corresponding depressions of the maxilla and lachrymal. The dorsal surface abuts against the maxilla; the surface of articulation conforms to the sinuous maxillo-malar suture consisting of two transverse ridges separated by a groove. The ventral surface is covered by the lachrymal as far laterad as the low ridge which runs latero-caudad from the antorbital notch, and this ridge on the left side and in the adult alone serves to demarcate the two bones. The exposed surface beyond the lachrymal calls for little comment. The zygomatic process is directed ventrad almost as in the Owen-Elliot skull and similarly is separated from the preorbital process by a relatively wide fissure. Correlated with this direction of the process is the inclination of the ventrorostral exposed surface which rises more above the level of the maxilla and faces more mesad than in the adult.

The lachrymal.— This is of but moderate size, its maximum transverse measurement being 54 mm. by 48 mm. sagittally. Its greatest thickness is 19 mm. The ventral surface is divided by a transverse ridge, caudal to which the bone is covered by the frontal. The smaller area in front of the ridge is free except rostrad where it is overlain by a plate-like extension of the maxilla, in consequence of which the exposed surface in the articulated skull is reduced to an L-shaped area. The dorsal surface bears the imprint of the malar in its lateral half. Between the concavities for the two conical processes a spine rises which fits into the notch of the malar. Mesal to this the surface is rugose and articulates with the maxilla.

Frontal.— The frontal ventrally is expanded into a massive orbital process with a considerable extension into the temporal fossa, and correspondingly participates in the closure of the cranial cavity. The remainder is pressed into a thin plate between the maxilla and the parietal extending almost to the vertex and fused to the parietal with which it unites to form the transverse crest. Between the frontals therefore is a wide gap where the maxillæ enter into the cranial wall. The orbital plate is grooved ventrally in its mesal two-thirds and the greater part of the groove is occupied by the orbito-sphenoid. On the cranial surface the suture uniting these elements has been obliterated but a faint remnant can be seen in the roof of the orbit. The frontal sends processes mesad both in front and behind the orbito-sphenoid. The rostral one is the longer and extends mesad to articulate firmly with the presphenoid and on the right side with the edge of the ala vomeris as well. This it just fails of reaching on the left, there being interposed a narrow strip of presphenoid. The caudal process reaches the extremity of the sphenoidal fissure. The caudal margin of the frontal runs laterad and caudal from the sphenoidal fissure to the infratemporal crest along which it passes caudad to reach the squamosal. It then ascends to the supratemporal crest; following which a short distance it becomes convex rostrad and then turns towards the vertex along the transverse crest. From sphenoidal fissure to infratemporal crest the frontal articulates with the ala temporalis. In the temporal fossa it is in contact superficially with the squamosal but deeply towards the cranial cavity with the reduced and fenestrated plate of the parietal. This bone thickens and comes to the surface at the supratemporal crest and thence towards the vertex is intimately joined to frontal though a remnant of the suture persists on the ectal surface of the skull. The lateral surface of the frontal is much like that of the adult, the pre- and postorbital processes are less developed, especially the latter and the supraorbital notch is feebly indicated. The angle that intervenes between parietal and maxillary is slender and acute and the only difference here from the adult is that the frontal may be followed almost to the vertex and is not yet completely amalgamated with the parietal. At the vertex the frontals are not in contact but are separated by an interval of about 1 cm. which is occupied by parietal and a median ridge of bone partly separate from parietal but synostosed to the right frontal which I take to be the interparietal.

The squamosal.— This bone in the articulated skull is deeply engaged between the frontal rostrad, the 'mastoid' process of the tympanic caudad, the exoccipital and parietal dorsad. Entad it abuts against the ala temporalis and the parietal. The mesal surface falls into two portions of very different character. Where it is in contact with frontal and parietal it is rough and marked with ridges of obliquely caudo-ventral direction. A rather deep groove intervenes between the frontal and parietal areas. The former has the shape of a pyramidal elevation and is received in a depression of the frontal. The parietal area is larger, elongated and imperfectly separated from the cranial cavity by a fenestrated plate of parietal, through the foramina of which it is visible from within. The surface for the ala temporalis, in strong contrast to the foregoing, is smooth and flat. It is roughly quadrangular and is surrounded by elevated edges which embrace the alisphenoid on all sides. These are thin and delicate except the caudal which forms a strong wedge received in a groove of the ala temporalis and abutting upon the junction of that bone with the occipital which excludes it from the wall of the lacerated foramen. Dorso-caudally the bone articulates with the parietal and exoccipital, meeting the former with a convexity and the latter with a concavity. A ridge separates the surface for the exoccipital from the moderate concavity for the tympano-mastoid. This is limited by a rough projection mesad which is free. Mesad there is another concavity corresponding to but not in actual contact with the periotic.

Of the remaining surfaces the temporal is defined by strong temporal and infratemporal crests. It forms the mesal and caudal wall of the fossa and is correspondingly concave. The lateral and zygomatic surfaces are separated by a long compressed plate, projecting ventrad, broken in the skull of the calf but well preserved in that of the adult. It seems to include the glenoid fossa together with the zygomatic and postglenoid processes. The fossa is an ill-defined concavity of the mesal surface, in a part of which the cortex is deficient, exposing the spongiosum. The zygomatic process is produced ventrad. Near its base is a small tuberosity projecting towards but not meeting the postorbital process. Beyond this the rostral surface is smooth as though for articulation with the malar.

The postglenoid process is thin and little more than a projecting angle. The zygomatic surface slopes away from the glenoid region. It is divided by an oblique ridge into a quadrangular mesal portion fitted between ala temporalis and processus ali-cochlearis and lying in the same plane; and a lateral, depressed and adjacent to the tympano-mastoid which is rough and marked by ridges and tubercles.

The pterygoids.— As a whole the 'pterygoid' forms a plate of general vertical orientation, convex laterad and attached to the basis cranii along an oblique line extending from the maxilla to the basioccipital. Rostrad its palatine portion is strongly inflected, forming a horizontal shelf and meeting its fellow for about one-fourth of its length. In this palatine region the bones are more asymmetrical than in the adult. The left one is broader, more strongly curved and having a greater concavity of its mesal margin, differences which are hardly to be perceived in the skull of the adult. The rostro-lateral angle is drawn out into a plate-like process, thin and narrow as compared with the adult, and by its tip barely touching the maxillary, with which it subsequently articulates firmly. By its deep surface this process is in relation with the palate bone, which in the adult is exposed only in front and behind it. Caudal to this process the border in the calf is smooth and sharp, in the adult jagged and overlying the palate. Caudal again is a rough concavity with elevated thin edges to embrace the pterygoid elevation of the maxilla. Behind this the pterygoid expands transversely, articulating with the ala of the vomer and sending laterad a strong process which is in contact with the adjacent region of the frontal and with the venter of the ala orbitalis, these elements here excluding it from contact with the presphenoid. Into the interval between the body of the presphenoid and basisphenoid however it projects by a conical process which interrupts the continuity between the sphenoid fissure and the basisphenoid-presphenoid cleft in the dry skull. Caudad to this is a rough triangle to articulate with the processus alaris, beyond which the pterygoid is applied to the lateral surface of the basi-occipital flanges. In this terminal portion the margin is thicker, smooth and received in a groove on the occipital. The free margin has a deep Eustachian notch, not constricted at its entrance as in the adult. The hamular process is thickened, narrower than in the adult and more pointed. In the suture line between the maxilla and pterygoid just behind the pterygoid eminence of the former and partly roofed over by the frontal is a large foramen leading into the nasal fossa. Another canal runs between the ala vomeris and pterygoid.

In the border of the tubal notch is a small furrow, the only indication of the two elements which compose the pterygoid among the Ziphioids. These are a caudo-lateral plate mainly behind the notch and a rostro-mesal which bears the hamular process and corresponds to the internal pterygoid of less modified skulls. Of the pterygoid apophysis of the alisphenoid there is no clear indication.

Os tympanicum.— The tympanic consists of an ental portion or bulla of smooth and very dense bone and a much larger lateral portion of irregularly pyramidal form which fits between the squamosal, the exoccipital and the otocranial flange of the basi-occipital presenting its broad base in the lateral surface of the skull. It thus imposes at first glance as a mastoid but is actually entirely free of the periotic both in the calf and in the adult. The dorsal surface in its ventral third is smooth and flat articulating with the otocranial flange. The remainder of the surface fits against the extremity of the exoccipital which it receives in a groove beyond which the margin is thick and tuberous. The concave surface is marked by narrow parallel furrows so that the bone appears to be made up of osseous strips laid close together and curving dorsad beyond the groove to present their extremities upon the thick margin. Mesal to this striated groove is a rectangular facet of dense bone, slightly convex in both directions and rising at its caudal margin into a low ridge. This region evidently corresponds to the processus petrosus ossis tympanici of Denker. It resembles that process of *Phocœna* further in the cavity in its interior which communicates with the tympanium, but the bone of *Kogia* is remarkable for the enormous expansion of this element into what for want of a better term may be called tympano-mastoid and further in the absence of anchylosis between it and the periotic which in *Phocœna* is established at an early period (Hyrtl). The free ventral surface of the tympano-mastoid is thick and massive rostrad, depressed into an elongated fossa in its caudal portion. The floor of the fossa is rough with thin osseous lamellæ set on edge. It attains its greatest depth close to the bulla with the result of reducing the processus petrosus to a plate of but moderate thickness at the mesal extremity of which the bulla is attached by a slender pedicle.

The bulla is rather short and broad. Its ventral surface has the shape of an irregular parallelogram. The long axis is nearly transverse. The rostral border is strongly rolled. The processus sigmoideus is large, almost egg-shaped with the smaller end ventrad. From its poles two ridges run mesad bounding a depressed area which has its mesal limit in a small elevation, probably corresponding to Denker's processus conicus anterior. In this case however it is mesal in position for the axis of the bulla is transverse, nearly at right angles to its direction in *Phocœna.* Of the ridges running from the processus sigmoideus, the rostral continues into the free margin of the bulla losing its identity at the point where the malleus is anchylosed. The caudal stops at the extremity of an oblique ridge or rather fold of the ventral surface, for it is visible entally as a groove, the only one present in this bulla. The processus conicus posterior s. lateralis is obscure. The mesal spout-like portion of the tympanic is short and not much narrower than the lateral portion from which it is set off by a groove ectally and a ridge entally. Just lateral to the groove is a prominent tubercle.

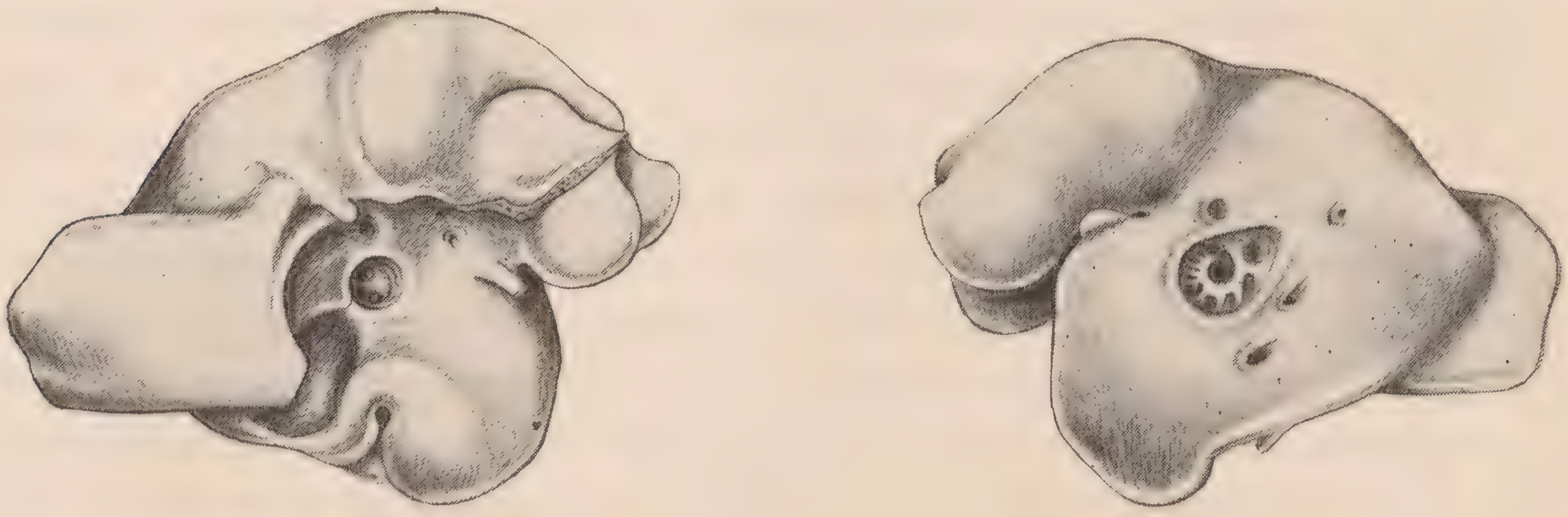


Fig. 1. Fig. 2.

Fig. 1. Right periotic of adult, ectal surface. Twice natural size.
Fig. 2. The same, ental surface.

The dorso-rostral surface is turned toward the periotic. This comprises the two lips of the bulla and the interval between them. The caudal lip is heavy and strongly rolled, presenting near its middle a shallow concavity which lies opposite but not in contact with the caudal pole of the pars cochlearis. The rostral lip is thinner and has a more complicated contour; from the annulus tympanicus it is directed mesad and is notched close to the processes sigmoideus which projecting rostrad overhangs the interval between the lip, of the bulla. At the end of the ridge continuing this process mesad is the attachment of the malleus, and mesal to this the margin is prolonged into an uncinate process which, strongly bent upon itself and with a globose enlargement of its deflected extremity, is received in a concavity of the periotic and firmly anchylosed with that bone.

The bulla is attached to the tympano-mastoid by a pedicle springing from the extremity of the processus perioticus. This consists of a stronger portion directed caudad and mesad from the caudal angle of the process to the caudal lip of the bulla and a thin lamella continuous with this but directed nearly ventrad towards the ventral wall of the bulla. The latter is deeply incised, the incisure together with the notch in the processus sigmoideus evidently serving for the attachment of the drum membrane.

Os petrosum.— The periotic is composed of a rather large pars cochlearis, a relatively small pars vestibularis. From the latter projects laterad a plate-like processus tympanicus (Denker) which Beauregard is no doubt right in interpreting as the regio mastoidea. Mesad a very bulky tegmen tympani projects from the pars vestibularis; to this is anchylosed the hooked process of the tympanic described above and by it excluded from the tympanic cavity.

On the rostral surface the limits of the pars vestibularis and pars cochlearis are defined by a series of foramina. Of these the largest and most dorsal is that of the facial canal, from which the nerve extends directly through the bone to emerge on its tympanic surface above the fenestra vestibuli; a genu upon the nerve, at least in its periotic course, is lacking. A very minute foramen more mesally placed is perhaps representative of the hiatus Falopii. Ventral to the orifice of the facial canal is a deep fossa at the bottom of which is the tractus spiralis foraminosus. In the same fossa but placed somewhat apart from and lateral to the foregoing is a small foramen which I take to be equivalent to the area cribrosa media. Outside the fossa, but close to its margin and ventro-laterally placed is the foramen singulare. Ventral to this at a distance of 2 mm. is the orifice of the aqueductus vestibuli, and at about the same distance farther ventrad the margin is incised by the fenestra cochleæ.

The caudal surface consists of the wall of the tympanum and a massive arch dorsal to this. The latter presents laterally in its mastoid region the facette for articulation with the processus petrosus of the tympanic. There is no anchylosis as in *Phocœna*. Adjoining this is a shallow fossa of triangular form which may represent the attic in a rudimentary condition. This is limited mesad by a sharp ridge of bone, the projecting extremity of which overhangs the facial groove. Between this and the tuberosity marking the beginning of the tegmen tympani is a vertical groove corresponding in part at least to the fossa incudis. The surface of the tegmen tympani beyond the tuberosity is concave for the reception of a thick hooked process of the tympanic to which it is firmly anchylosed.

In the tympanic cavity the facial canal is open in its whole length from a point above the fenestra vestibuli. In its ventral portion it borders upon a large fossa for the m. stapedius. The fenestra vestibuli is broadly oval, 2.5 mm. in its long axis by 2 mm. dorso-ventrally. Between the fenestra and the tuberosity of the tegmen tympani is a fossa for the head of the malleus. Mesal to the fenestra vestibuli the surface is concave becoming distinctly grooved toward the margin. The groove corresponds when the bones are in apposition to the interval between the lips of the bulla and would seem therefore to enter into the composition of the osseous tuba. In its upper portion a thin ledge projects mesad and ventrad, the processus cochleariformis, the interval between which and the uncinate process would seem to correspond to the usual groove for the tensor tympani. This muscle has been generally recorded as absent in whales, and Denker [1] so reports of *Phocæna*. It is however present in the fœtal *Balænoptera* (Kernan) [2] and the conformation of this region of the periotic, which differs markedly from that of *Phocæna* as given by Denker (Taf. xv, fig. ii), suggests the possibility of the presence of the muscle in *Kogia*.

The promontory is narrow and arched mesad and ventrad about the fenestra cochleæ which is placed at the ventral margin of the bone at the confines of the tympanum. Mesal to the fenestra the pars cochlearis is produced ventrally into a projection which corresponds to the concavity of the caudal lip of the bulla. The fenestra itself is elongated, 3 mm. by 1.5 mm. at its broadest point. A small projection from its lateral margin gives it a slightly reniform contour.

The pars vestibularis is pyramidal and massive; its ventral surface is largely concealed by the processes which arise from it. The mastoid or processus tympanicus is quadrangular, its surface concave and smooth as though covered by an articular cartilage. Its ventral angle overhangs the facial canal. The tegmen tympani is very robust. Its origin from the pars vestibularis is marked by a shallow groove beyond which it presents two tuberosities one above the tympanum mesal to the facette for the malleus, the other above the entrance to the facial canal. The tegmen then narrows, in large part because of the concavity in which is fused the uncinate process of the tympanic, and terminates mesad in two tubercles. Rostrad the surface of the pars vestibularis rises to a blunt point just mesal to which is the minute orifice of the aqueductus vestibuli.

---

[1] Denker, A. Zur Anatomie der Gehörorgans der Cetacea. Anat. Hepte, Bd. 19, 1902.

[2] Kernan, John D. Jr. In Mem. A. M. N. H., New Series, Vol. I, Pt. VI, pl. XLVII, fig. 3, and p. 493.

The malleus.— Of the auditory ossicles the malleus alone is present, and of this only the head and processus gracilis are distinguishable; the manubrium has been fractured and lost. The fragment is ankylosed to the tympanic by the lower portion of the caput at the mesal extremity of the processus sigmoideus. Mesal to this the processus gracilis is also synostosed to the lip of the bulla and the anterior ligament is converted into bone. The surface for the incus is divided by a groove into two facettes of which the upper is much the larger and broader.

The foregoing notes on the individual cranial bones substantiate the highly specialized character of the skull adumbrated in its general contours. Among its many peculiarities the entrance of the maxilla into the cranial cavity is perhaps the most astonishing and is so far as I am aware unique. Its history is not difficult to surmise. The great suprafrontal extension of the maxilla in Odontocetes is associated with the development of the rostrum serving to secure that structure to the cranium. It thus comes to overlie the squama of the frontal, to a very high degree in Ziphioids, all but completely in *Physeter* and *Kogia.* In the fœtal skull of *Physeter* in the Royal College of Surgeons, described by Owen,[1] the frontal seems to persist and exclude the overlying maxilla from the cranial cavity. In *Kogia* extensive reduction of the frontal has taken place, possibly in association with the extreme brachycephalism of the smaller whale.

The synostosis between the lachrymal and malar is very complete in the adult, and even on one side of the calf no sign of their primary independence can be distinguished. These conditions afford some ground for the expectation that when suitable material is at hand, the lachrymal may prove to be more generally present in the Odontocetes than at present appears. In the absence of a suborbital bar of the malar, *Kogia* presents an extreme reduction of this bone. The lacking portion is supplied by ligament. An approach to this condition is afforded by *Inia* [2] in which there is a broad gap between the extremity of the malar and the zygomatic process of the squamosal.

The compound nature of the pterygoid is a morphological problem of great difficulty. Of the two elements, the rostral bearing the hamular process and articulating with the palatine and maxillary may with confidence be taken as the internal pterygoid plate, highly developed and gaining a rostral extension. The morphology of the caudal element is doubtful. It can hardly be an external pterygoid plate for that element is uniformily an apophysis of the cartilaginous alisphenoid and lacks even an independent center of ossification. On the alisphenoid itself there is no projecting process it is true, but in the caudo-mesial region where it abuts upon the occipital and enters into the wall of the jugulo-acoustic canal, the bone is deeply fissured. By means of these fissures the bone is resolved into two closely apposed processes; a mesial one adjacent to the basisphenoid canal is possibly the ali-cochlear process, the lateral one may be a highly modified external pterygoid plate. On this assumption the second element of the 'pterygoid' could be interpreted as a reduplication of the internal pterygoid plate, a supposition for which I know of no analogy, or its origin must be sought in some secondary site of membranous ossification, perhaps the wall of the adjacent air sinus. In any event this problem, which pertains to Odontocetes in general, must await its solution until younger material is made available for study.

---

[1] Owen, R. Catalogue of the Osteological Series in the Museum of the Royal College of Surgeons, London, 1853; also *op. cit.*, Trans. Zool. Soc. London, VI, 1869.

[2] Flower, W. H. Description of the skeleton of *Inia geoffrensis* and of *Pontoporia blainvillii*, with remarks on the systematic position of these animals in the order Cetacea. Trans. Zool. Soc. London, Vol. VI, 1869.

To summarize: The chief osteological peculiarities of the *Kogia* skull, which is that of a highly specialized eutherian mammal are, proportions and asymmetry apart, its mid-facial sagittal crest, the participation of the maxillæ in the wall of the cranial cavity, the suppression of both nasals, and the complete reduction of the suborbital bar of the malar.

COMPARISON OF IMMATURE SKULLS OF *Physeter* AND *Kogia*.

For purpose of comparison several accounts of young skulls of *Physeter* are available. The first is that of Owen, already referred to, of the fœtal skull in the Museum of the Royal College of Surgeons. A disarticulated skull of about the same size in the Museum of St. Bartholomew's Hospital is mentioned by Flower,[1] who has also reproduced in excellent lithographs the cranium of a half grown specimen from Tasmania. Huxley[2] gives three wood-cuts of a fœtal skull.

Of these the Tasmanian specimen is for our purpose of most importance as most nearly coinciding in size. The rostrum, though far from its adult length, is more robust than in *Kogia* in all its proportions, especially exceeding it in length. The transverse curvature, ventrally convex, dorsally concave, is pronounced. The wide antorbital notches and less developed maxillary tuberosities lend it an appearance of greater independence from the cranium, against which it is crowded in *Kogia.* The premaxillæ are narrower, separated only by a linear interval at the tip and present longer areas beside the vomer ventrally. The vomerine gutter is also proportionally narrower and rostrad is roofed over by the premaxillæ. Proximad the left bone terminates at the level of the nostril but is less depressed into the funnel of that passage than in *Kogia.* The maxillæ are also more slender, are widely separated in the transverse crest where they overlie the frontal and do not enter into the cranial cavity. The infrafrontal process abuts obliquely on the lachrymo-malar and is not produced backward upon it as in *Kogia.* The palate bones are very large and enter conspicuously into the walls of the nasal passages. The pterygoids are correspondingly smaller, the infrapalatine portions feebly developed and fail by a wide interval of reaching the maxillæ. Caudad their extent is limited also by the transverse direction of the otocranial flanges of the basioccipital. On the whole therefore the rostrum is less complicated in its attachment to the cranium than in *Kogia* and fixation is secured rather by the massive proportions of the elements involved than by very peculiar specialization of their articulations.

---

[1] Flower, W. H. *Op. cit.*, Trans. Zool. Soc. London, Vol. VI, 1869; also Van Beneden and Gervais, *op. cit.*, pl. xix.

[2] Huxley, T. H. A manual of the Anatomy of vertebrated animals. Fig. 106.

In the fœtal skull Owen states that the pterygoid is double the size of the palate, a point not borne out by Huxley's figure, in which however the pterygoid has no infrapalatine process.

In *Physeter* the disproportion of the nostrils is less, the right is slightly more caudal in position and the intervening septum, though deviated, is very robust, and so may play a larger rôle in the fixation of the rostrum. The left nasal bone is a flat scale resting upon the frontal in a position corresponding to the premaxillary of the right side. Laterad it touches the maxilla, rostrad the ethmoid.

The transverse crest while of great height is less robust than in *Kogia,* and in particular the maxillary tuberosities are far less massive. The absence of the mid-facial crest gives this aspect of the skull the form of a simple concavity.

The great fossa on the base lateral to the pterygoid ridge has apparently a less complicated relief than in *Kogia.* Rostrad it passes quite evenly into the venter of the beak. The alisphenoid is of large size and juts rostrad coming to underlie the orbito-sphenoid. This it joins laterad (Owen) thus excluding the frontal from the sphenoidal fissure. In the alisphenoid in addition to the foramen ovale there is according to the same authority a separate rotundum. The optic foramen is likewise separate. In all these points *Kogia* departs from *Physeter,* the underlying factor perhaps being the backward push of the rostrum and shortening of the whole region in the pigmy whale.

In the adult sperm whale the infraorbital arcade is complete and massive. In the half grown specimen the malar is attenuated at its junction with the zygomatic process of the squamosal. In Owen's fœtus this junction was fibrous, while in Huxley's figure a considerable interval is shown. In this retardation of development of the caudal extremity of the malar is initiated a process which has been carried to the suppression of the whole suborbital bar in *Kogia.* Owen suspected the presence of a lachrymal in both whales, but finding no evidence of its independence in the fœtal sperm whale suggested that it had become connate with the malar. It is to be presumed on the evidence of *Kogia* that in younger fœtuses of the sperm whale it may also be for a time separate.

The temporal fossa of *Physeter* extends higher than in *Kogia* and is less definitely limited above. Its mesal wall is more largely formed by frontal. The orbital plate is very massive, supraorbital notch and pre- and postorbital process are conspicuous.

The chief peculiarity of the occipital in *Physeter* consists in the very high position of the very prominent condyles, which extend onto the supraoccipital (Owen). In consequence an oblique descending canal is formed leading to the cranial cavity (Flower). The statement that the hypoglossal nerve has no independent canal (Flower) is in need of corroboration.

While differing in contour and notably in the length of the symphysis, the mandible agrees with that of *Kogia* in its marginal thickening of the pars papyracea, a character which distinguishes these whales from the Ziphioids and other Odontocetes in general.

The foregoing comparison has dealt only with the cranial differences between the two genera of the Physeterinæ. It has not seemed desirable to retail the profound resemblance which have served to collocate the two forms since the first observation of the skull of *Kogia.* As compared with one another *Kogia* seems to show more striking modifications of the cranium, in only a few characters does *Physeter* possess equally marked peculiarities. Of these the modification of the occipital region associated with the high position of the condyles is the most notable. To this may be added the enormous length of rostrum, of the mandibular symphysis, the large palatal bone and the extreme development of the processes of the skull. In other important respects, the persistence of the left nasal, the retarded but ultimately complete suborbital arch, smaller pterygoid, less degree of disparity of the nostrils, *Physeter* stands nearer to usual odontocete conditions than does *Kogia,* which in addition to these differences has developed the mid-frontal crest and has a maxilla which replaces the frontal in the cranial wall. The palatal of *Physeter* it may be well to state is here looked upon as secondarily enlarged, because the infrapalatine process though of considerable size fails to reach the maxilla, while a pterygo-maxillary contact is present in *Kogia* and all the Ziphioids. The conclusion seems therefore warranted, subject to the limitation that cranial characters are alone considered here, that *Kogia* is the more highly modified form but that both have deviated in different directions from the common ancestral type.

LITERATURE OF KOGIA.

BEDDARD, F. E. A book of whales. London and New York, 1900.

BENHAM, W. B. On the anatomy of *Cogia breviceps*. *Proc. Zool. Soc. London*, Vol. I, 1901.

On the larynx of certain whales (*Cogia, Balænoptera, Ziphius*). *Proc. Zool. Soc. London*, Vol. I, 1901.

Notes on the osteology of the short-nosed sperm-whale. *Proc. Zool. Soc. London*, Vol. 1, 1902.

BLAINVILLE, H. M. D. DE. Sur les cachalots, *Ann. franc. et étrange. d'Anat. et de Physiol.*, T. II. 1838.

BLANFORD, W. T. The fauna of British India, including Ceylon and Burma. Mammalia. London, 1888–91.

DELAGE, Y. Capture d'un cachalot du genre *Kogia* Gray sur les côtes de la Manche à Roscoff. *C. R. Ac. Sc.*, T. CXLII. 1903.

ELLIOT, D. G. A catalogue of the collection of mammals in the Field Columbian Museum. *Field Col. Mus. Pub., Zoöl. Ser.*, Vol. 8. Chicago, 1907.

FLOWER, W. H., and LYDEKKER, R. An introduction to the study of mammals, living and extinct. London, 1891.

GRAY, J. E. Zool. of the Erebus and Terror. London. 1846.

On the skeleton of *Kogia macleayii*. *Ann. and Mag. Nat. History*, Ser. 4, Vol. 12, 1873.

Catalogue of the specimens of mammalia in the Collection of the British Museum. Part I. Cetacea. London, 1850.

Catalogue of seals and whales in the British Museum. London. 1871.

Supplement to the catalogue of seals and whales in the British Museum. London. 1871.

GILL, T. The sperm-whales, giant and pygmy. Am. Nat., Vol. IV, 1871.

HAAST, J. On the occurrence of a new species of *Euphysetes* (*Euphysetes pottsii*) on the coast of New Zealand. *Proc. Zool. Soc. London*, 1874.

HASWELL, W. A. On the brain of Grey's whale (*Kogia greyi*). *Proc. Linn. Soc. N. S. Wales*, Vol. 8, 1883.

HECTOR, J. Notes on the whales of the New Zealand seas. *Trans. and Proc. N. Zeal. Inst.*, Vol. X, 1877.

Krefft, G. Notice of a new species of sperm-whale belonging to the genus *Euphysetes* Macleay. *Proc. Zool. Soc., London*, 1865.

Le Danois, E. Sur l'organ à spermaceti du *Kogia breviceps* Blain. *C. R. Ac. Sc.*, 1910.

Recherches sur l'anatomie de la tete de *Kogia breviceps* Blainv. *Arch. Zool. exp. et gen.*, 5e serie, T. IV. 1910.

Recherches sur les viscères et le squelette de *Kogia breviceps* Blainv. avec un résumé de l'histoire de ce Cétacé. *Idem.*, T. VI, 1911.

Lydekker, R. The new natural history. London and New York, 1891.

Owen, R. On some Indian Cetacea collected by Walter Elliot, Esq. *Trans. Zool. Soc. London*, Vol. VI, 186~~9~~.6

Note to memoir on the Indian cetacea collected by Sir Walter Elliot. *Idem.*, Vol. VI, 186~~9~~.7

Scammon, C. M. The marine mammals of the northwestern coast of North America described and illustrated; together with an account of the American whale fishery. San Francisco, 1874.

Sclater, W. L. The mammals of South Africa. London 1900–1.

Van Beneden, P. S., and Gervais, P. Ostéographie des cétacés vivants et fossiles comprenant la description et l'iconographie de squelette et du systèm dentaire de ces animaux. Paris. Atlas, 1868–1879. Text, 1880.

Wall, W. S. History and description of the skeleton of a new sperm-whale lately set up in the Australian Museum, together with some account of a new genus of sperm-whales called Euphysetes. Sydney 1851, reprinted 1887. The latter issue has been used.

DESCRIPTION OF PLATES.

Skull of *Kogia breviceps*.

Plate XXXV.

Fig. 1. Skull of adult, norma verticalis.
Fig. 2. Skull of adult, norma lateralis.

Plate XXXVI.

Fig. 1. Skull of adult, oblique ventral view.
Fig. 2. Skull of adult, norma basalis.

Plate XXXVII.

Fig. 1. Cranium of calf after removal of rostrum, presphenoid and pterygoids.
Fig. 2. Skull of calf, norma occipitals.

PLATE XXXVIII.

Fig. 1. Maxillæ and premaxillæ of calf, mesal view.
Fig. 2. Maxillæ of calf, ventral view.

PLATE XXXIX.

Fig. 1. Vomer, ethmoid and presphenoid of calf, ventral view.
Fig. 2. Vomer, ethmoid and presphenoid of calf, dorsal view.

PLATE XL.

Fig. 1. Vomer, ethmoid and presphenoid of calf, right lateral view.
Fig. 2. Vomer, ethmoid and presphenoid of calf, left lateral view.

PLATE XLI.

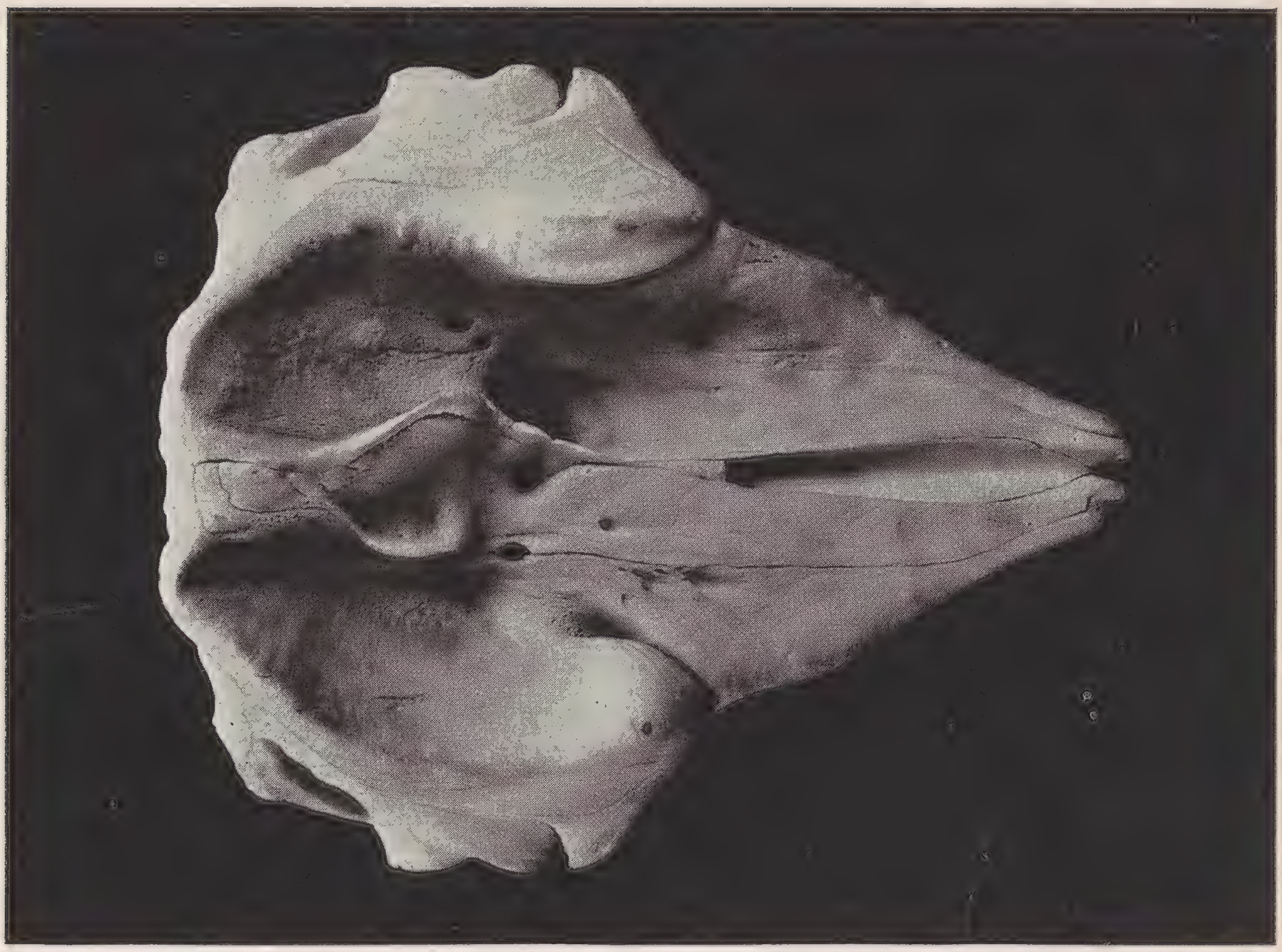
Fig. 1. Right pterygoid of calf, dorsal view.
Fig. 2. Right pterygoid of calf, mesal view.
Fig. 3. Left pterygoid of calf, lateral view.

PLATE XLII.

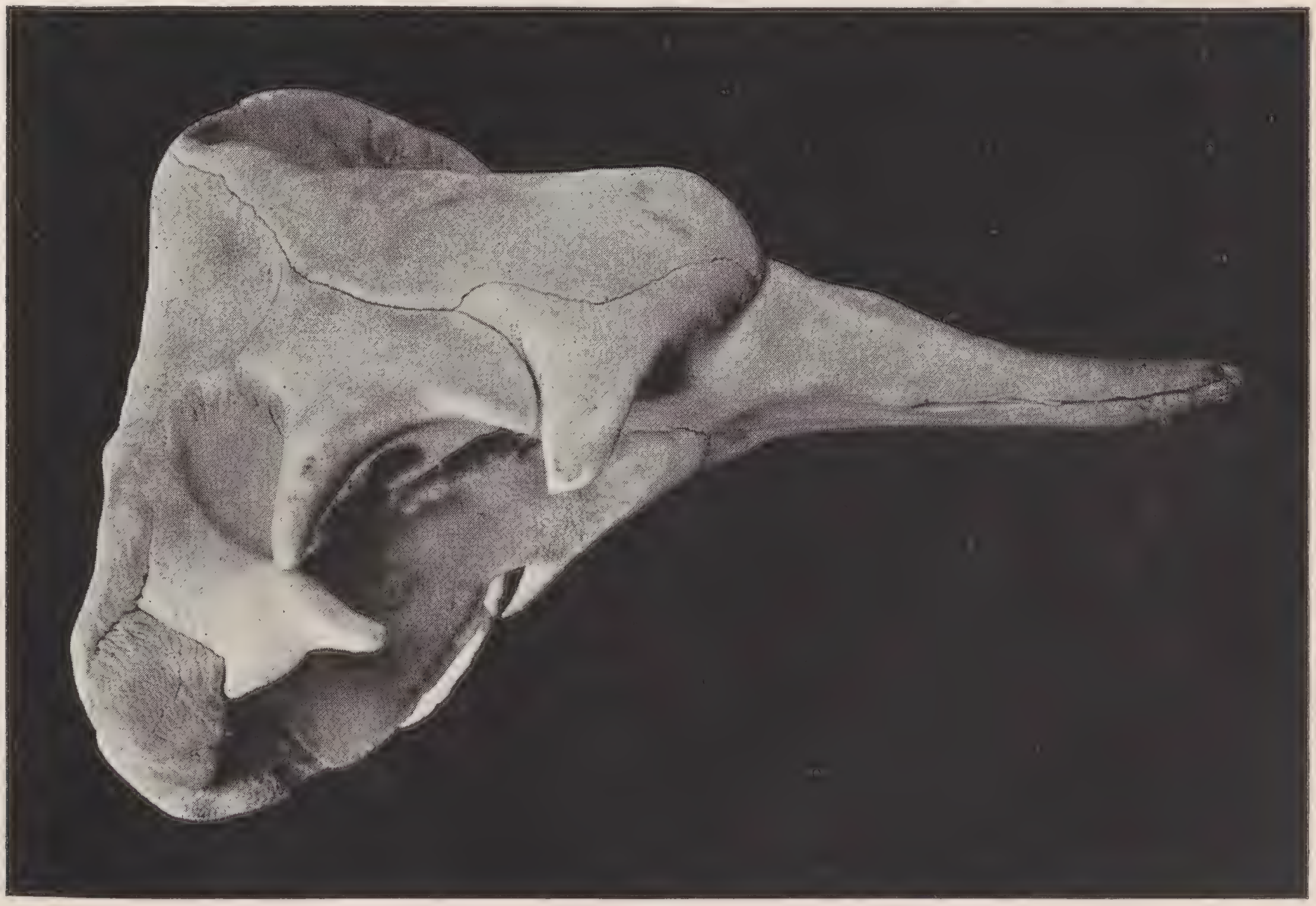
Fig. 1. Rostral cranial wall of calf composed of presphenoid and maxillæ.
Fig. 2. Left malar and lachrymal of calf, ventral view.
Fig. 3. Left malar of calf, dorsal view.
Fig. 4. Left lachrymal of calf, dorsal view.

PLATE XLIII.

Fig. 1. Left lateral region of the basis cranii of the calf, the squamosal and pterygoid having been removed.
Fig. 2. Left squamosal of calf, ventral view.
Fig. 3. Left tympanic of calf, ventral view.
Fig. 4. Left tympanic of calf, dorsal view.

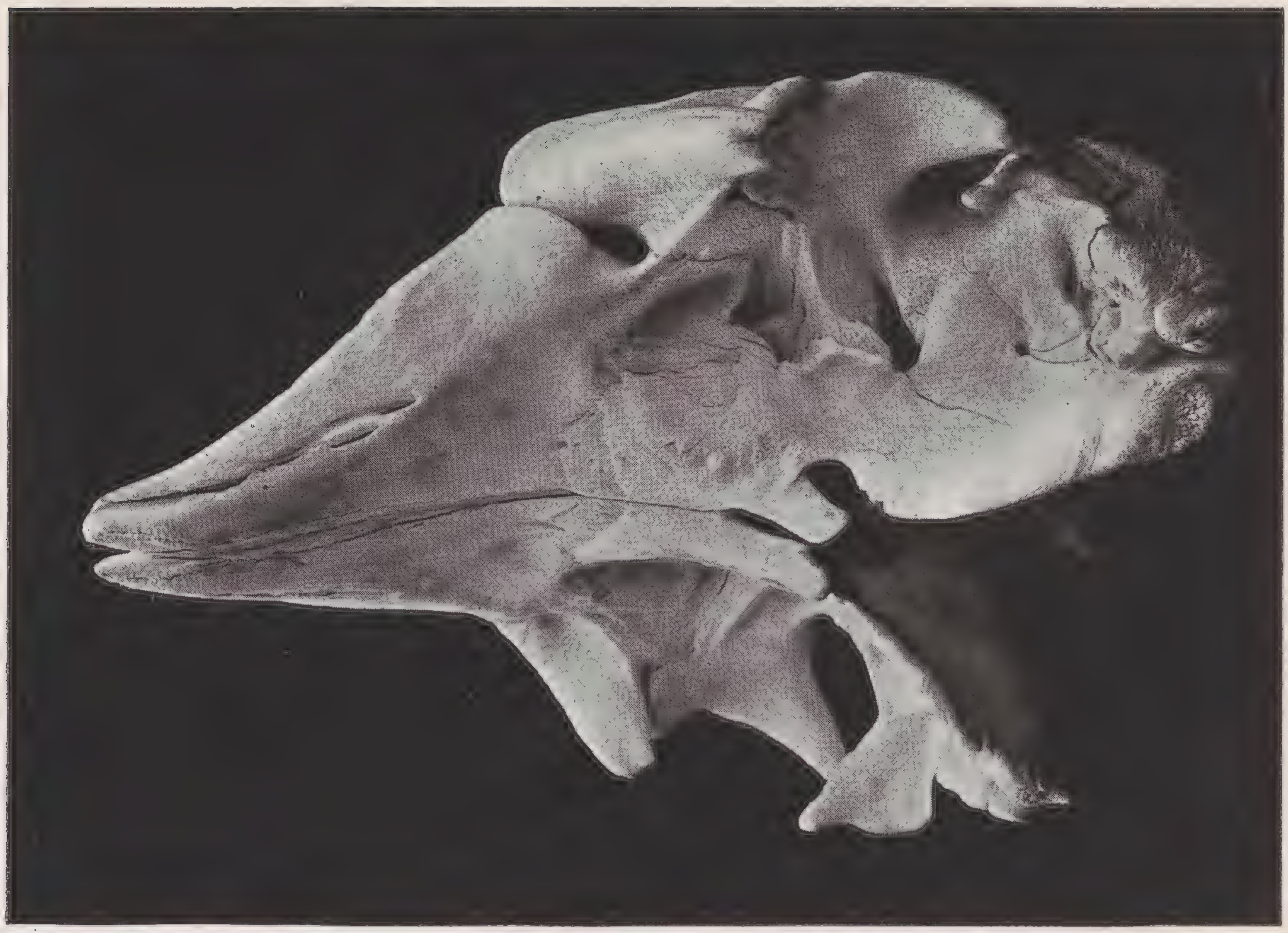


1

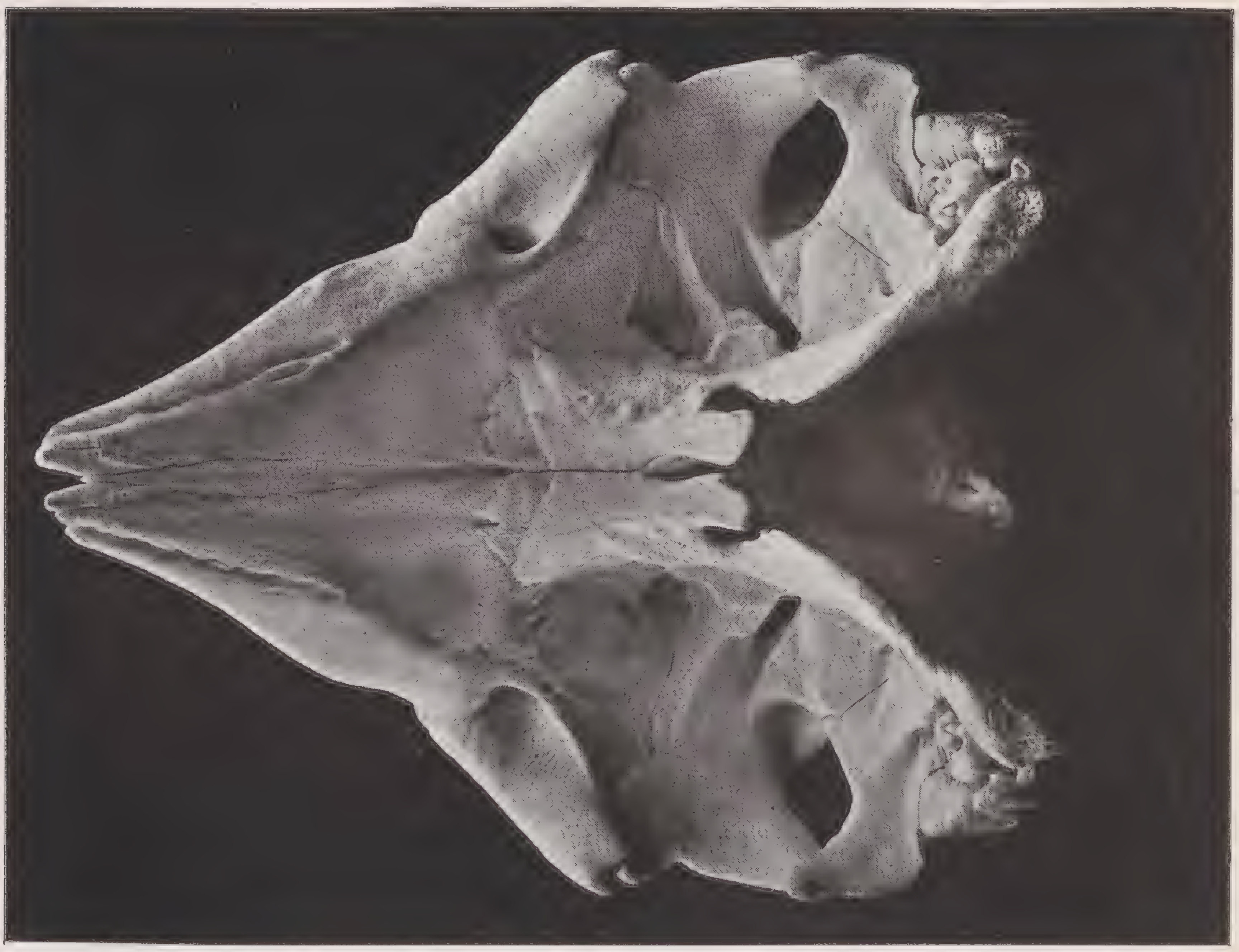


2

Kogia breviceps (*Blainville*).

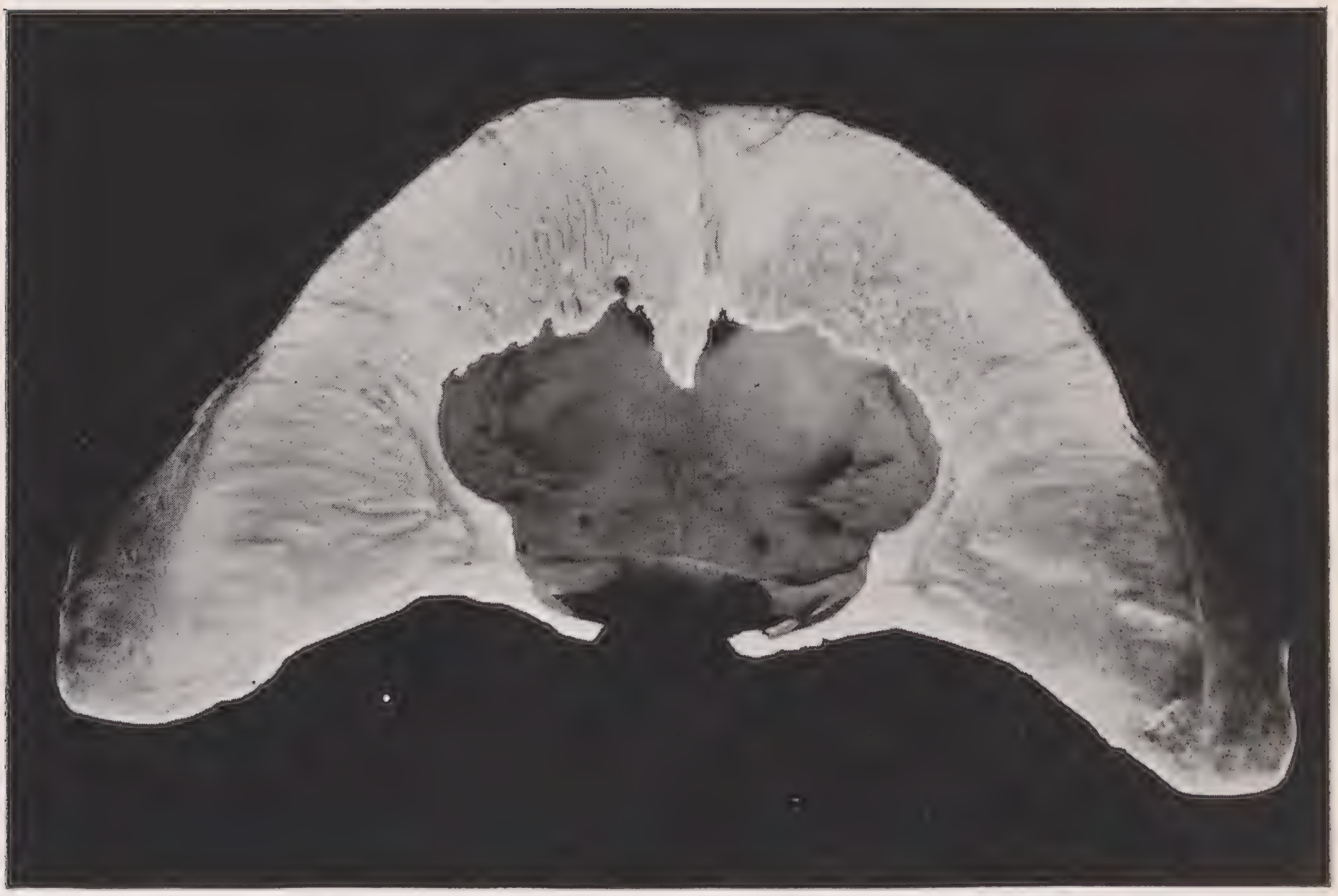


1

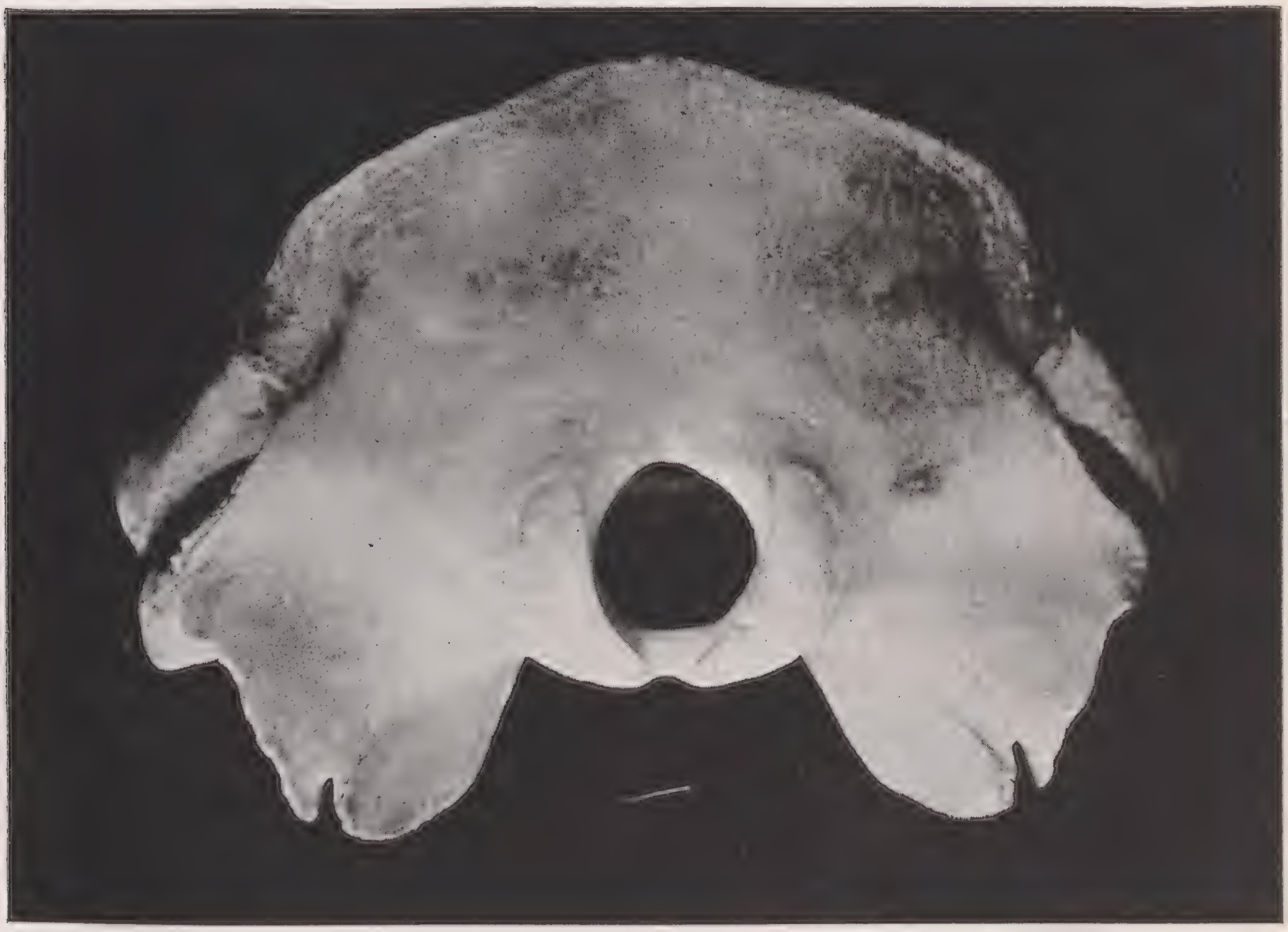


2

Kogia breviceps (*Blainville*).

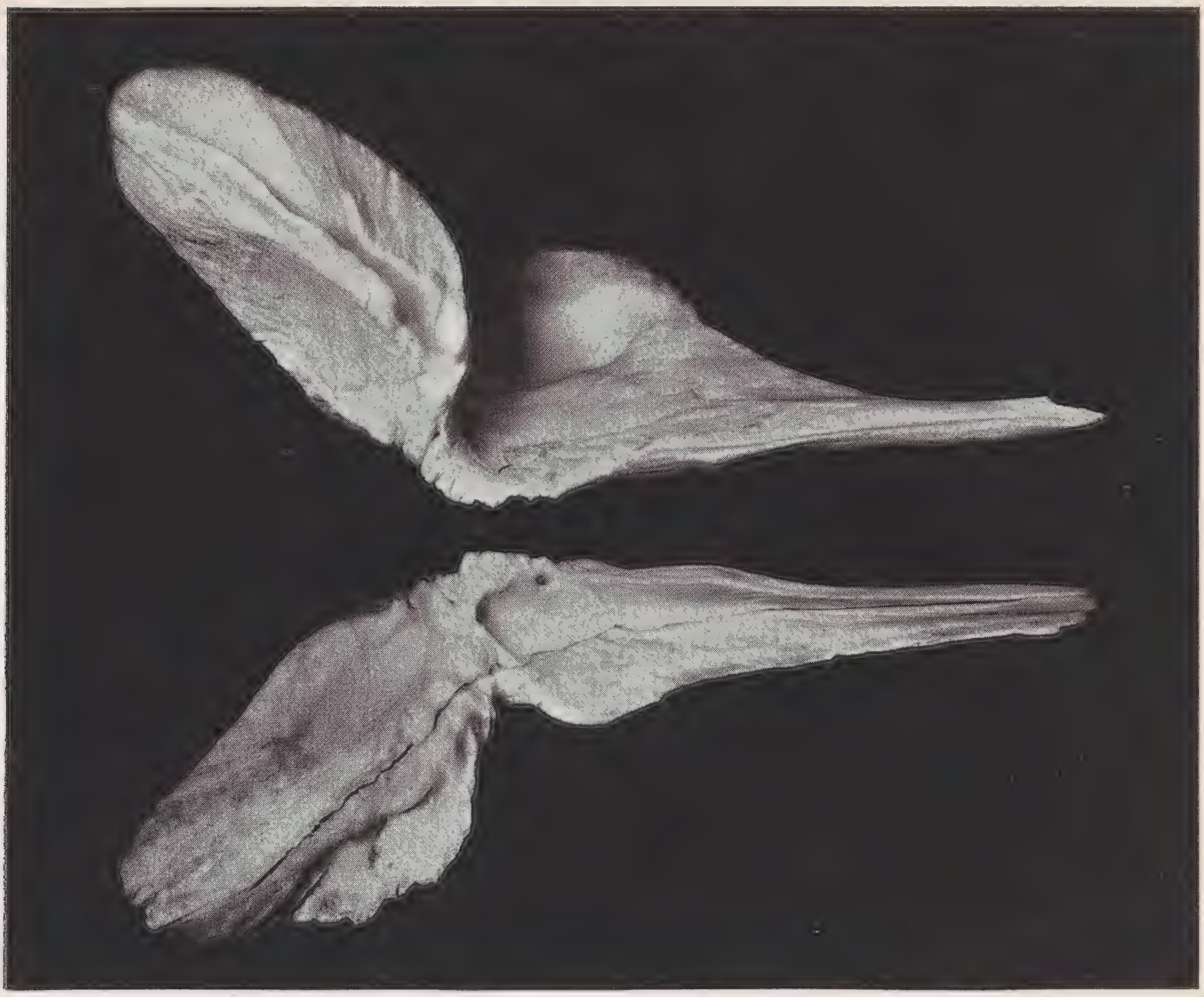


1

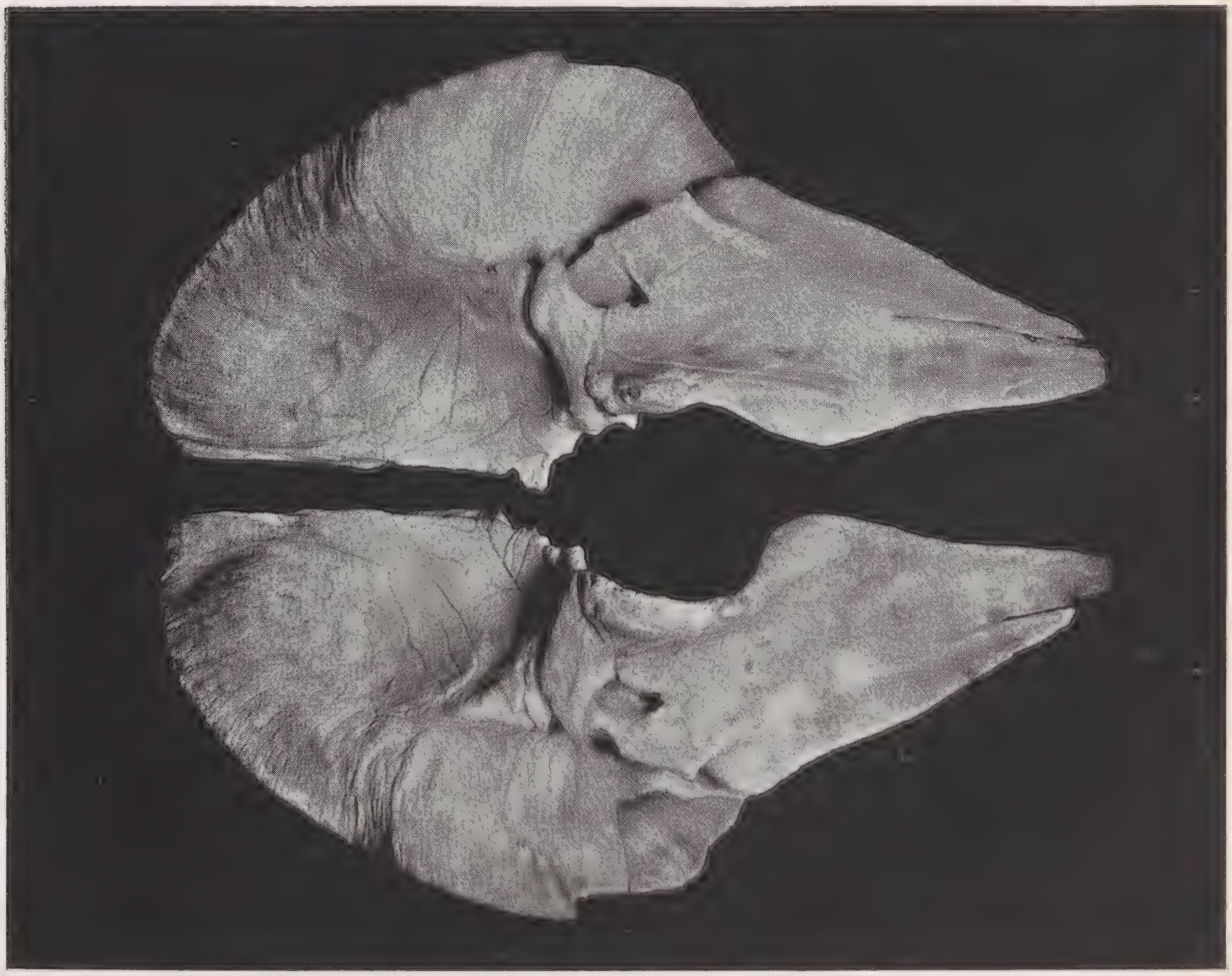


2

KOGIA BREVICEPS (*Blainville*).

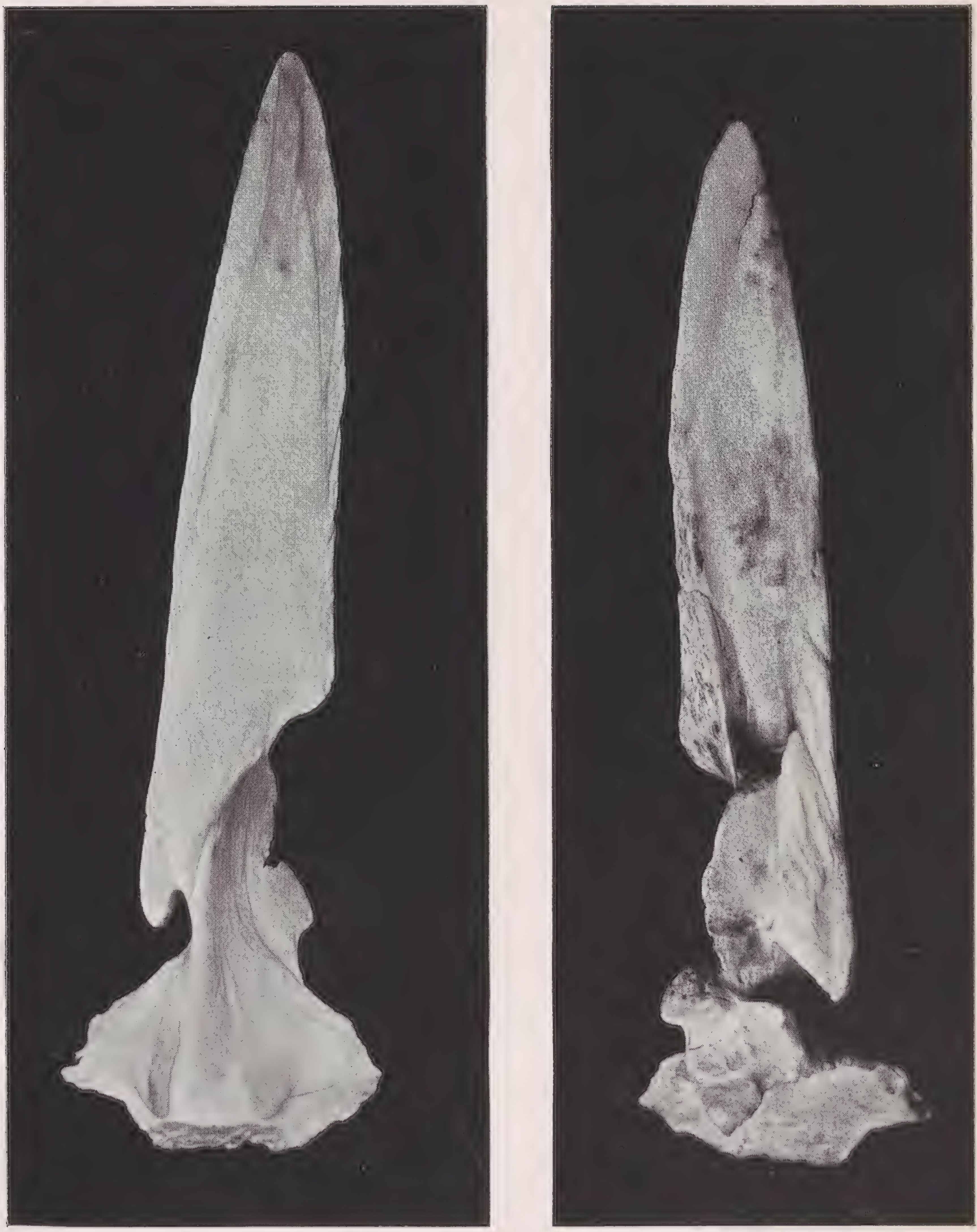


1



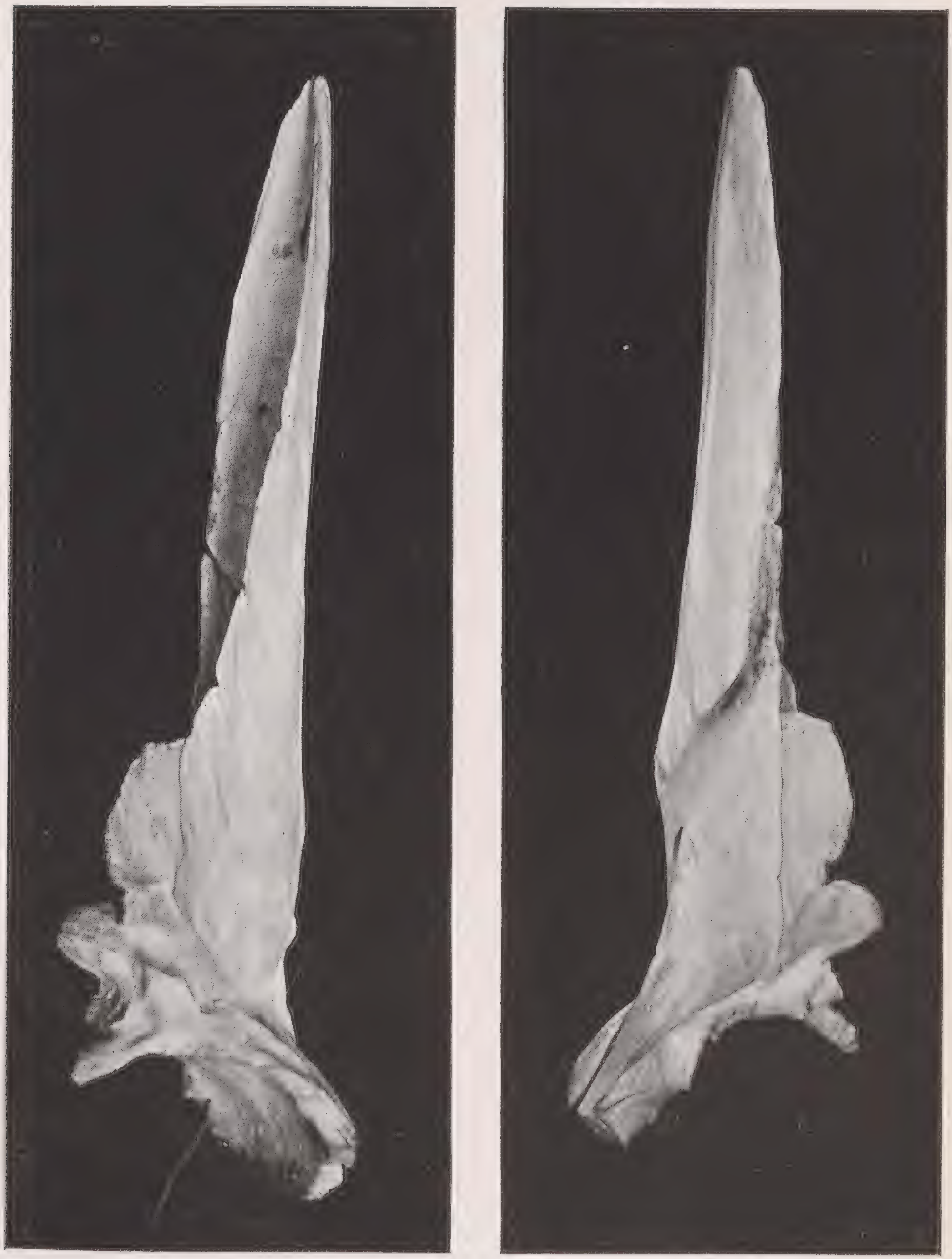
2

KOGIA BREVICEPS (*Blainville*).



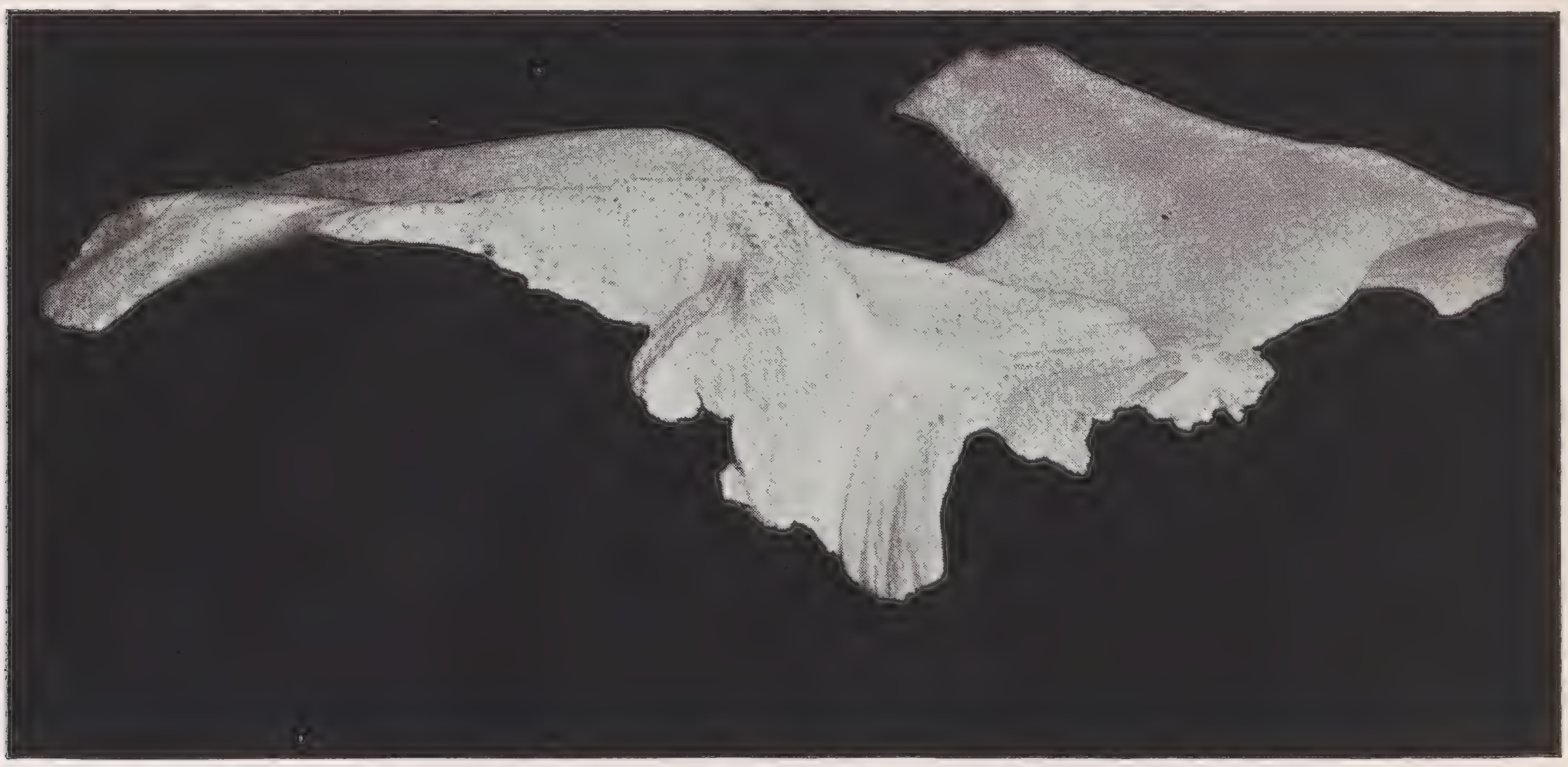
1 2

Kogia breviceps (*Blainville*).

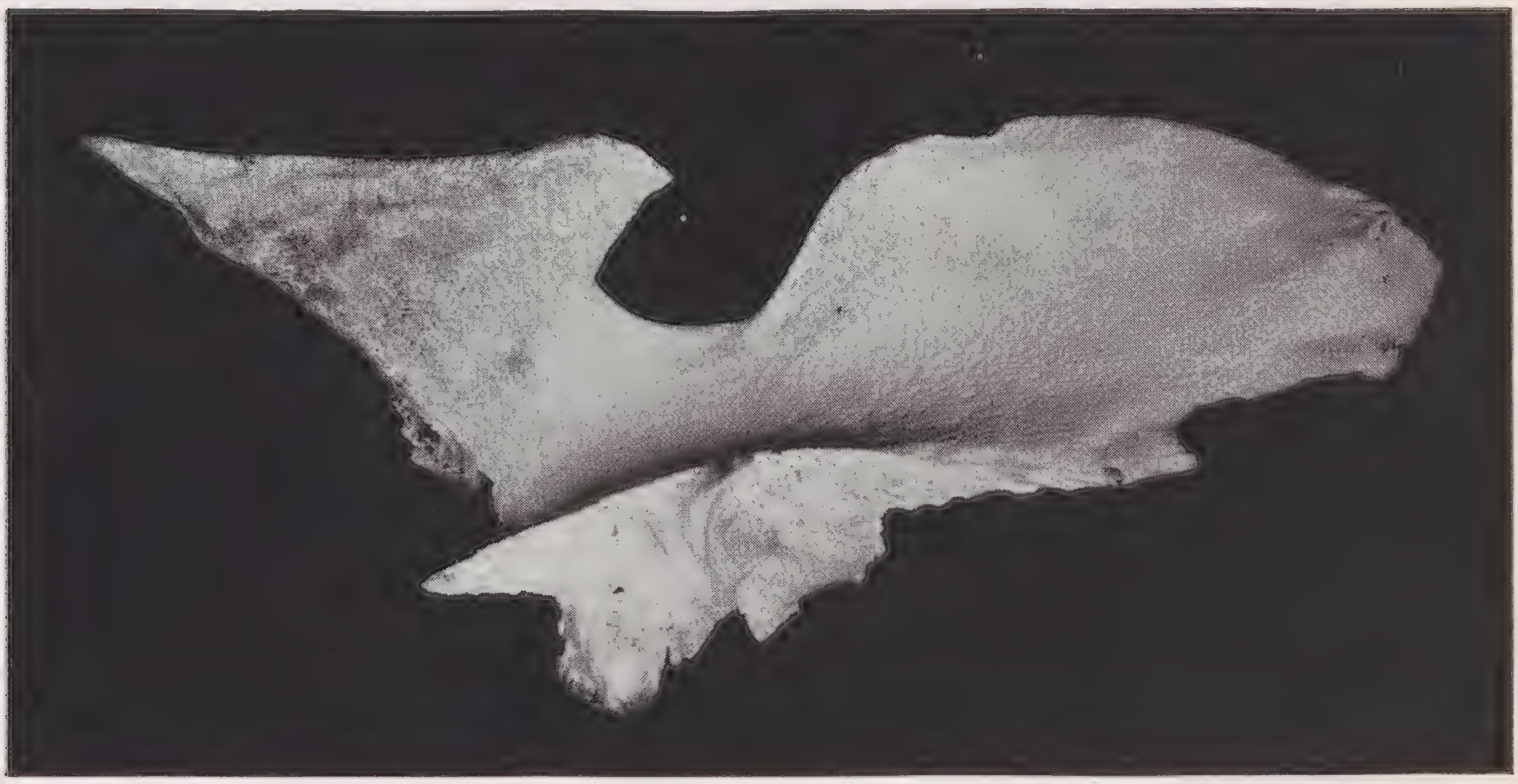


1 2

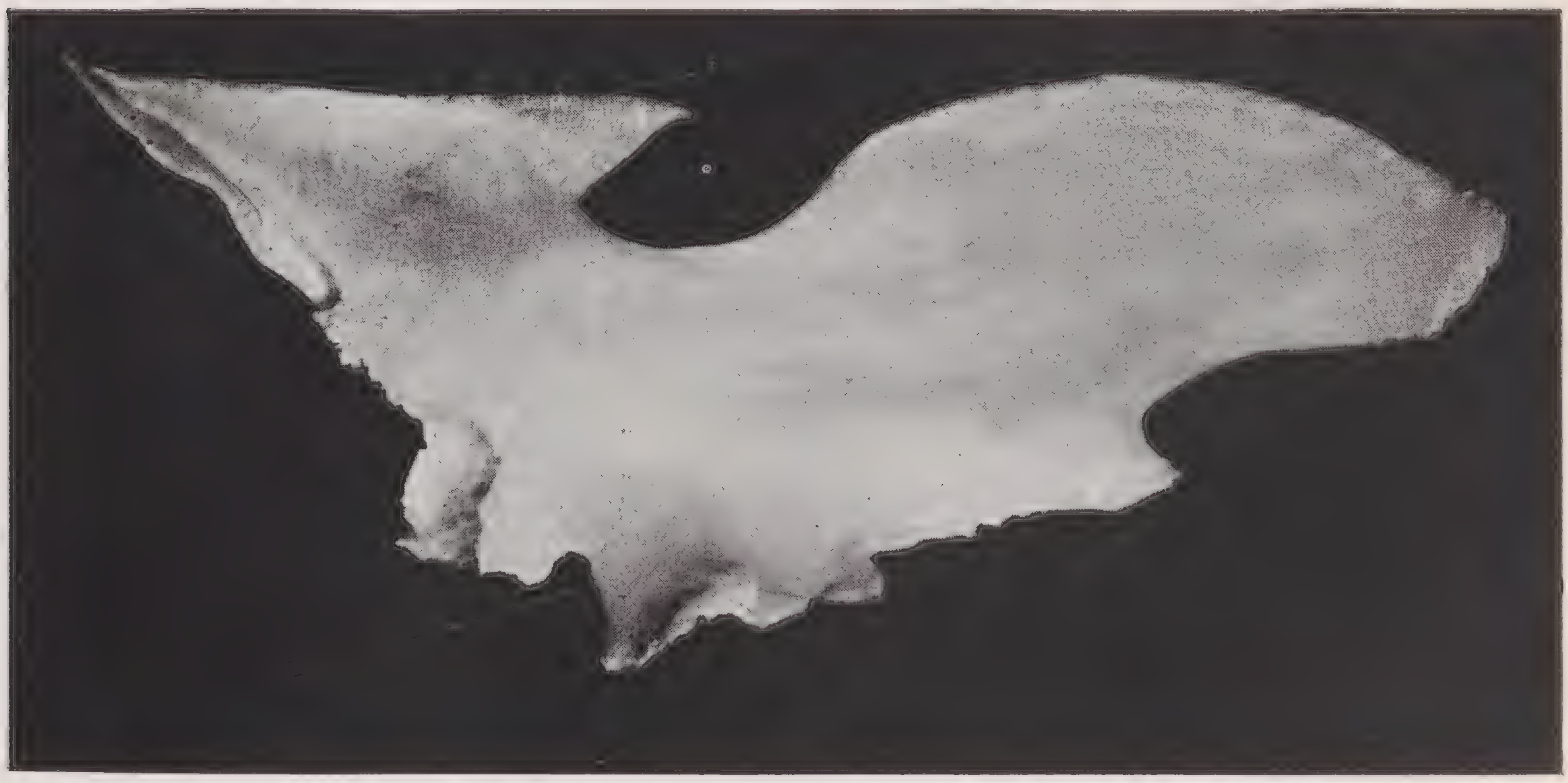
Kogia breviceps (*Blainville*).



1

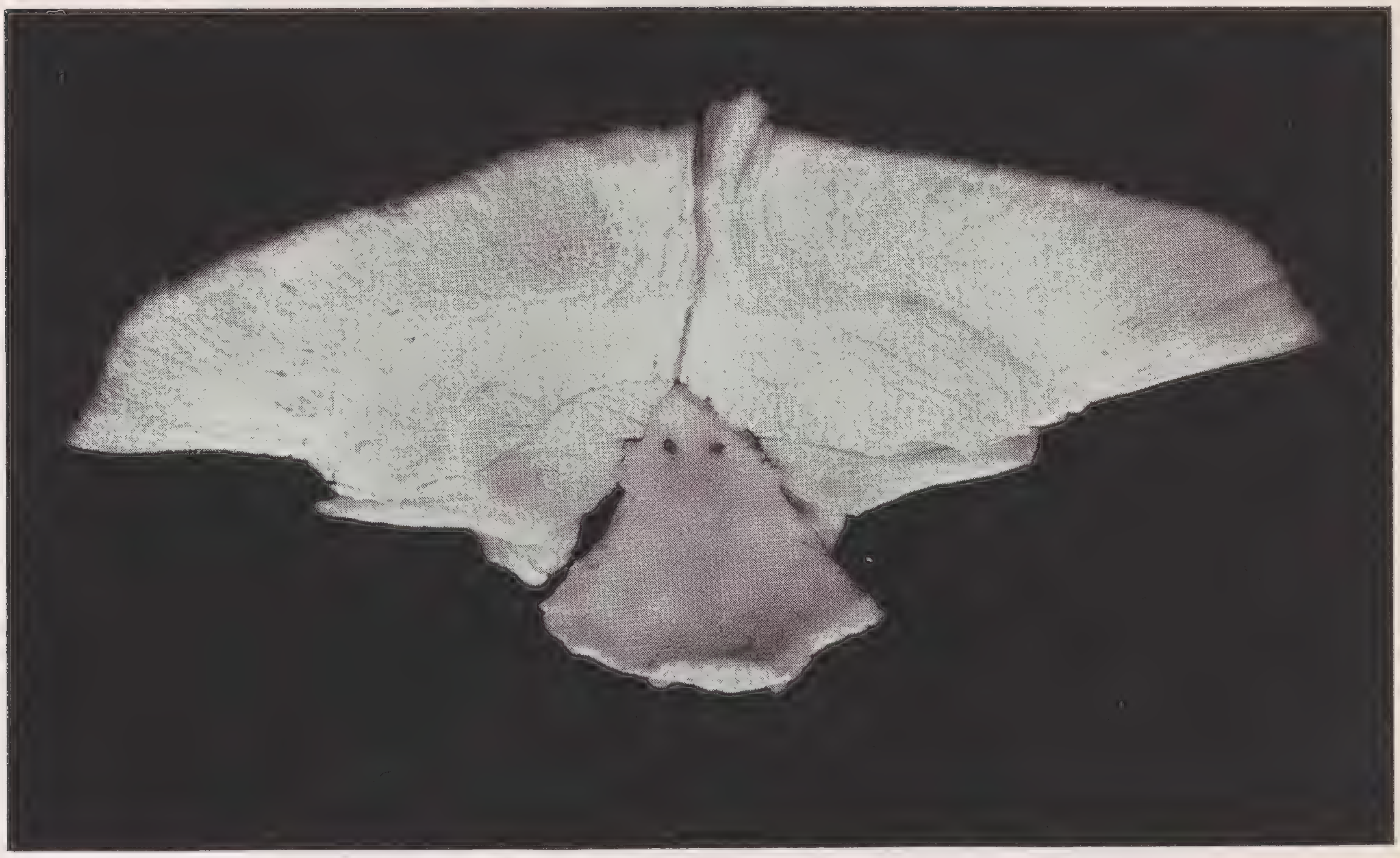


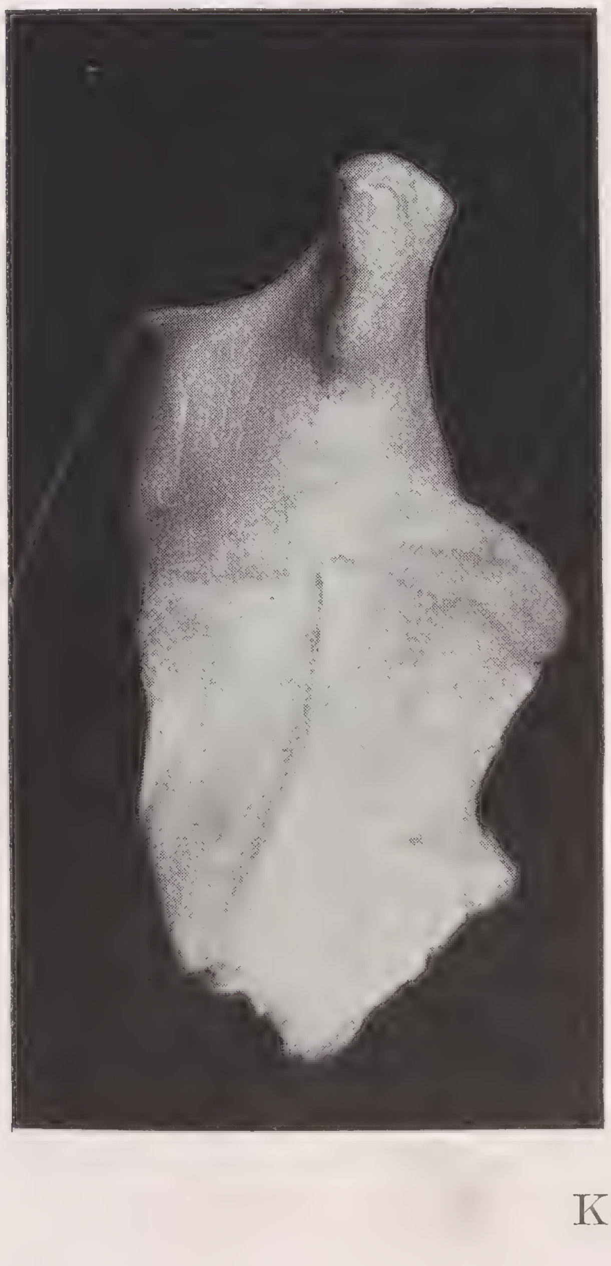
2

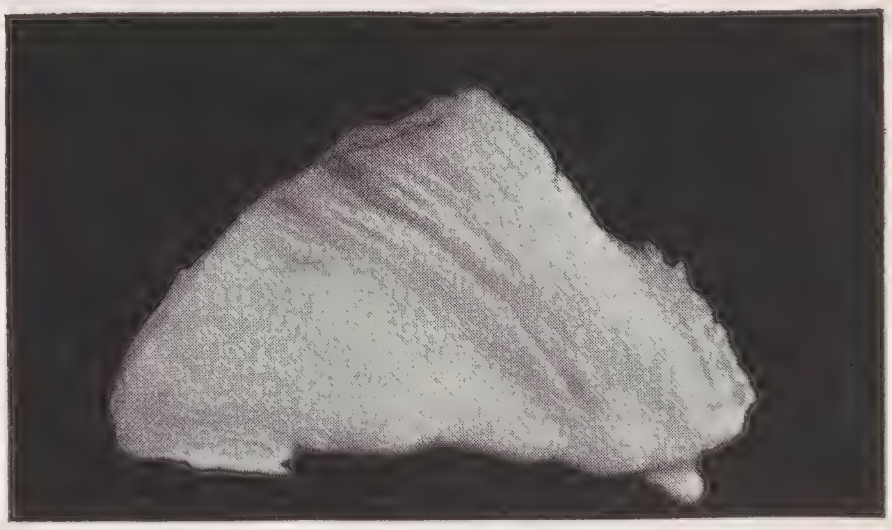


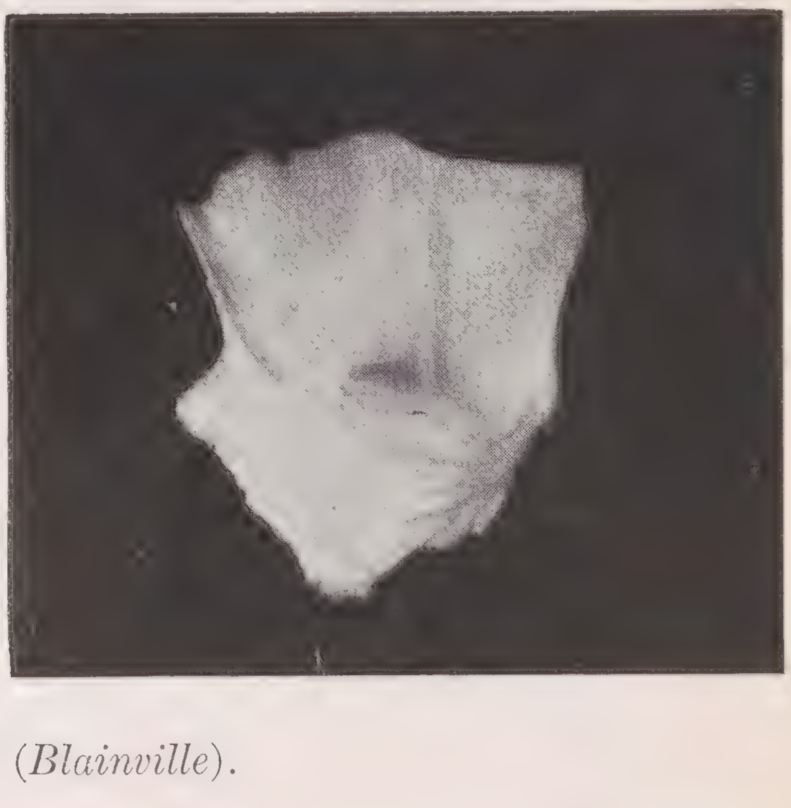
3

KOGIA BREVICEPS (*Blainville*).


1

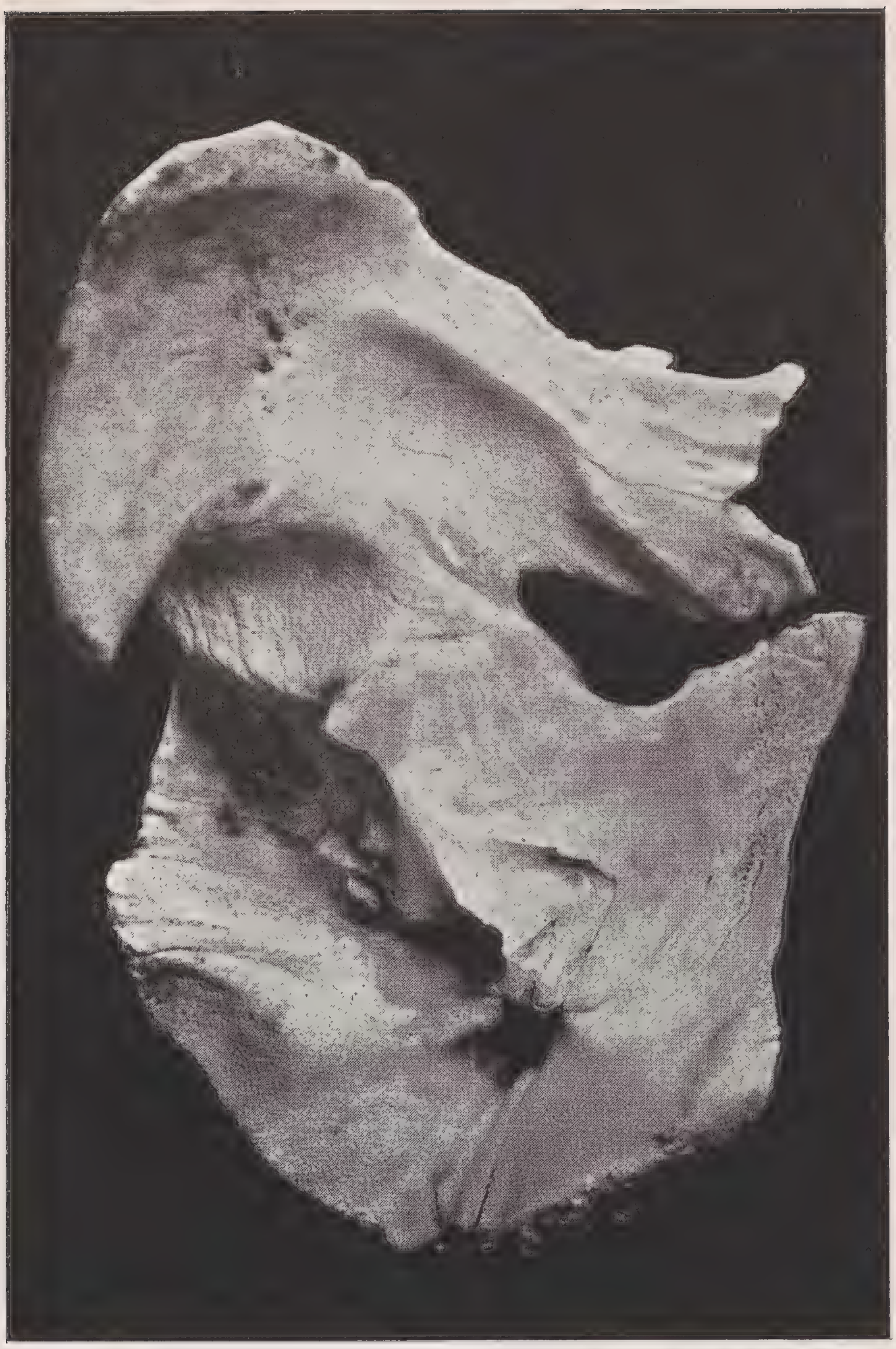

2

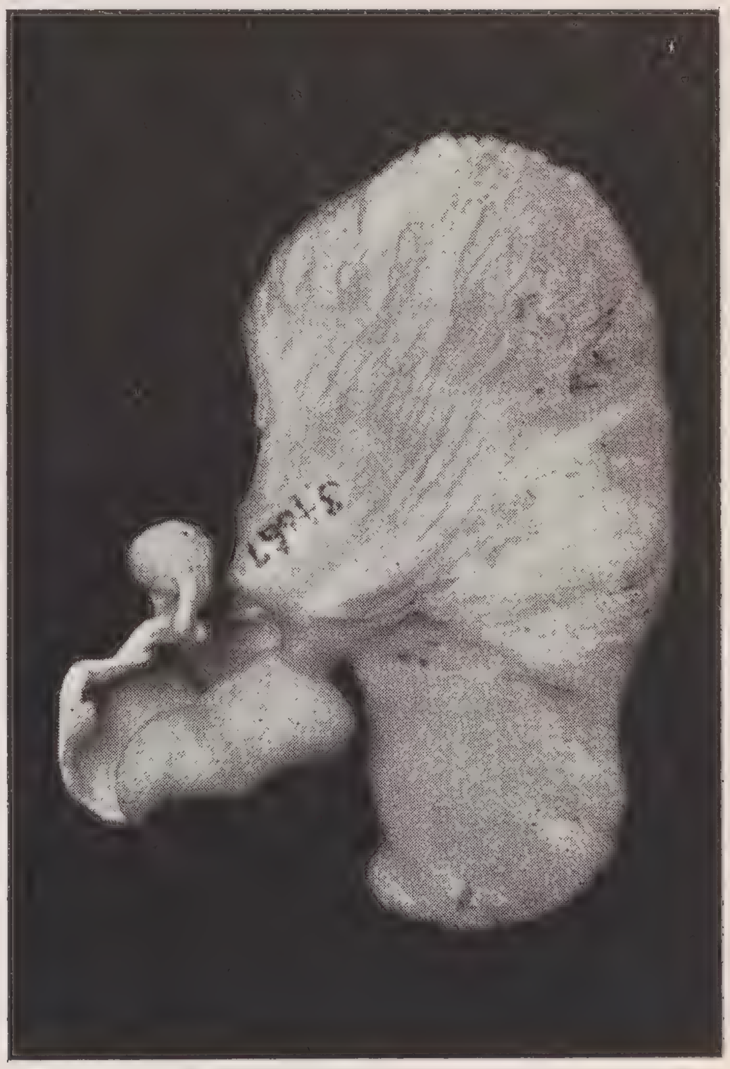

3


4

KOGIA BREVICEPS (*Blainville*).

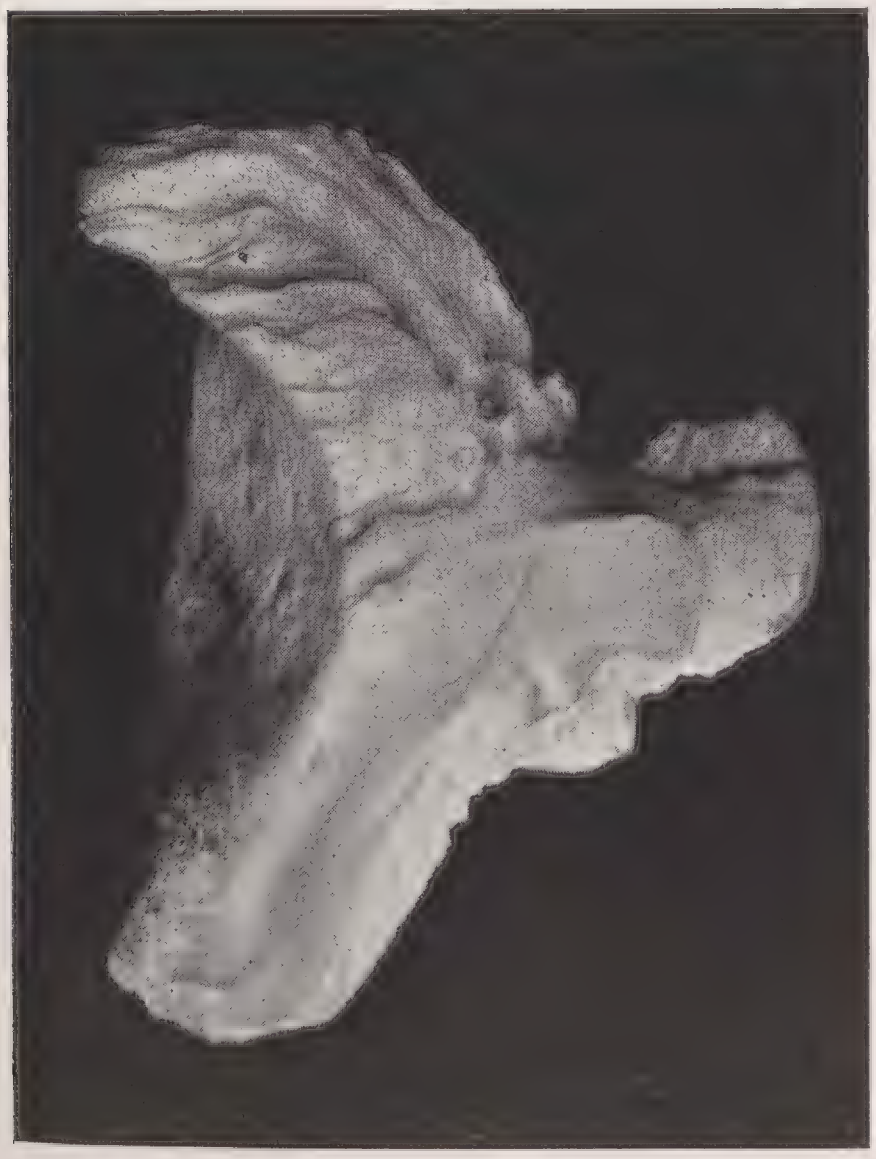
1

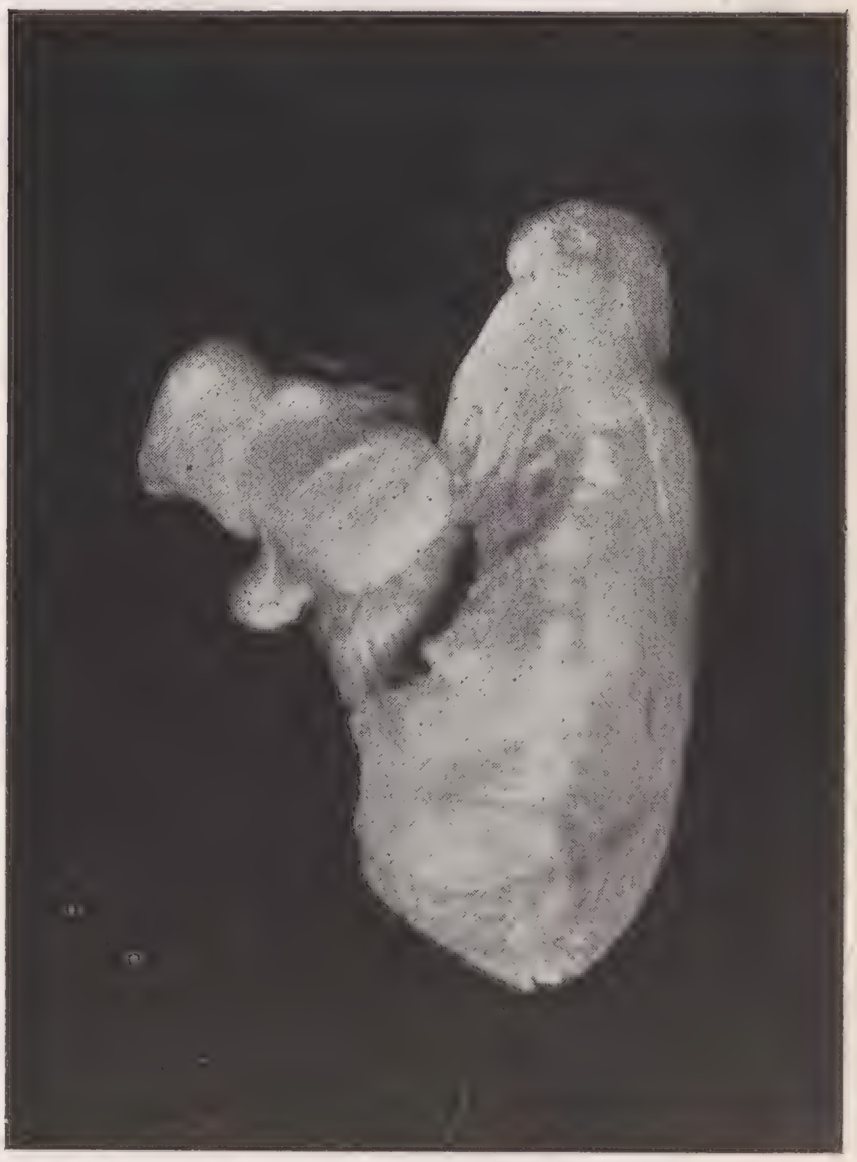




4

2





3

KOGIA BREVICEPS (*Blainville*).

59.9.4 (67.5)

Article XVIII.— THE AMERICAN MUSEUM CONGO EXPEDITION COLLECTION OF BATS.[1]

BY J. A. ALLEN, HERBERT LANG AND JAMES P. CHAPIN.

PLATES XLIV–LV, 26 TEXT FIGURES, AND MAP.

CONTENTS.

PAGE.

I. Systematic List. J. A. Allen 405

II. Notes on the Distribution and Ecology of Central African Chiroptera. Herbert Lang and James P. Chapin 479

III. Field Notes. Herbert Lang and James P. Chapin 497

PART I. SYSTEMATIC LIST.

BY J. A. ALLEN.

The collection of Bats obtained by the American Museum Congo Expedition consists of 794 specimens, representing 68 forms (65 species and 3 additional subspecies). About 250 specimens are preserved in alcohol; the remainder are well prepared skins with skulls, full field data, and measurements taken from the specimens before skinning. The percentage of missing or defective skulls is small — much less than in any other large collection of mammals it has ever been my privilege to study. This material is thus in the highest degree satisfactory for research. Its determination, however, has been difficult and laborious, due to the impossibility of making direct comparison of the specimens with types or other authentic material in the museums of Europe, owing to the present disturbed international relations.

The American Museum of Natural History had practically no African material representing this order of mammals previous to the reception of the Lang-Chapin Congo collection, and the other museums of this country have comparatively little. This, however, has been kindly placed at my disposal and has proved of great service. I am indebted to Samuel Henshaw, Director, and to Dr. G. M. Allen, curator of mammals, of the Museum of Comparative Zoölogy at Harvard University, for the loan of 23 specimens from the Blue Nile region and from British East Africa; and to the authorities of the United States National Museum, through the kindness of Mr. Gerrit S. Miller, Jr., curator of mammals, for the loan of 77 specimens of African Molossidæ and Vespertilionidæ. Although very few of the 30 species represented in these loans were contained in the Lang and Chapin collection, they were nevertheless of much assistance in working out the species in the latter. It was therefore necessary to proceed with the work almost exclusively from the basis of the literature.

---

[1] Scientific Results of the Congo Expedition. Mammalogy, No. 2.

Andersen's work on the Megachiroptera[1] has rendered comparatively easy the determination of the specimens of this suborder; Miller's 'The Families and Genera of Bats'[2] has been invaluable as a general guide to the minor groups. Aside from a few papers reviewing special groups of species, the literature is widely scattered, the latest general revision being Dobson's 'Catalogue of Chiroptera,'[3] published nearly thirty years ago.

The bat fauna of the Belgian Congo is apparently poorly represented in museums, judging from the infrequency of references to specimens from this region in literature.[4] A considerable number of species, however, have been described from bordering districts which should naturally be expected to occur in Belgian Congo, but they are for the most part unrepresented in the present material. A number of them are based apparently on single specimens, sometimes alcoholic, and the descriptions are consequently not entirely satisfactory as an adequate basis for critical comparison. It is not therefore surprising that the present large amount of material should include a considerable number of new forms, some of them of obvious distinctness from any previously recorded, while others seem nearly related to forms described from contiguous countries, with which direct comparison has in most cases been impossible. In such instances it has seemed preferable, in view of the geographical conditions and the apparent discrepancy in characters involved, to give names to such forms than to merge them with forms already described to which they seem not properly referable. Of the 68 forms here recorded, 29 are described as new. Two superspecific groups are also characterized, one of which (*Allomops*, p. 470) is closely related to *Mops*, the other *Lophomops*, p. 460) to *Chærephon.*

---

[1] Andersen, Knud. Catalogue of the Chiroptera in the Collection of the British Museum. Second Edition, Vol. I, Megachiroptera. 1912. 8vo, pp. ci + 854, text figs. 1–79.

[2] Miller, Gerrit S., Jr. The Families and Genera of Bats. Bulletin 57, United States National Museum, 1907. 8vo, pp. xxvii + 282, pll. i–xiv, text figs. 1–49.

[3] Dobson, George Edward. Catalogue of the Chiroptera in the Collection of the British Museum. 1878. 8vo, pp. xliii + 567, pll. 30.

[4] The following papers relating to the mammal fauna of the Congo region list a few species of bats, as follows:

Dollman, Guy. Notes on Mammals collected by Dr. Christy in the Congo and by Dr. Bayer in Uganda and British East Africa. Rev. Zoolog. Africaine, IV, fasc. 1, pp. 75–90, July, 1914.

This paper includes 9 species of Chiroptera, 6 of which are from the Congo, as follows:

Epomops franqueti (Tomes). Stanleyville, 5; Avakubi, 2; Mambaka, 2.
Hipposideros cyclops (Temm.). Avakubi, 2.
Hipposideros caffer (Sund.). Avakubi, 1.
Nycteris hispida (Schreb.). Avakubi, 2; Funda, 1; Makala, 1.
Kerivoula cuprosa Thomas. Avakubi, 2 ad. and 2 juv.
Taphozous mauritianus E. Geoffroy. Stanleyville, 1.

Thomas, Oldfield. List of Mammals (exclusive of Ungulata) collected on the Upper Congo by Dr. Christy for the Congo Museum, Tervueren. Ann. and Mag. Nat. Hist. (8), XVI, pp. 465–481, December, 1915.

Lists 8 species of Chiroptera, as follows:

Eidolon helvum (Kerr). Medje, 1.
Epomops franqueti franqueti (Tomes). Medje, 1; Ituri, 1.
Hipposideros caffer (Sundevall). Poko, Welle district, 10.
Nycteris grandis Peters. Poko, 1.
Nycteris hispida (Schreber). Medje, 1; Poko, 3.
Scotophilus nux Thomas. Medje, 2.
Otomops martiensseni (Matschie). Poko, 1.
Myopterus albatus sp. nov. Welle River, 1 (collected by M. Hutereau).

Thomas, Oldfield. On small Mammals obtained in Sankuru, South Congo, by Mr. H. Wilson. Ann. and Mag. Nat. Hist. (8), XVIII, pp. 234–239, August, 1916.

Lists 19 species, of which 2 are bats, as follows:

Eidolon helvum (Kerr). Inkongo, 2.
Saccolaimus peli (Temm.). Inkongo, 1.

In working up this intensely interesting collection I have been greatly indebted to Mr. Herbert Lang, the leader and organizer of the Expedition, and to Mr. James P. Chapin, his able and enthusiastic co-worker during the six years of their continuous, exceptionally successful and intelligent field work in Equatorial Africa for invaluable information regarding the environmental conditions and relationships of the localities at which the present material was collected. Their contribution of field notes and illustrations to the present paper I am sure will be recognized as the most important contribution ever made to the life-history of the Chiroptera of Africa. The text illustrations of the cranial and external characters of certain species are contributed by Mr. Chapin, except those of the skull of *Kerivoula cuprosa,* which were made by E. S. Christman. The plates are from drawings by Mr. Chapin and from field photographs by Mr. Lang.

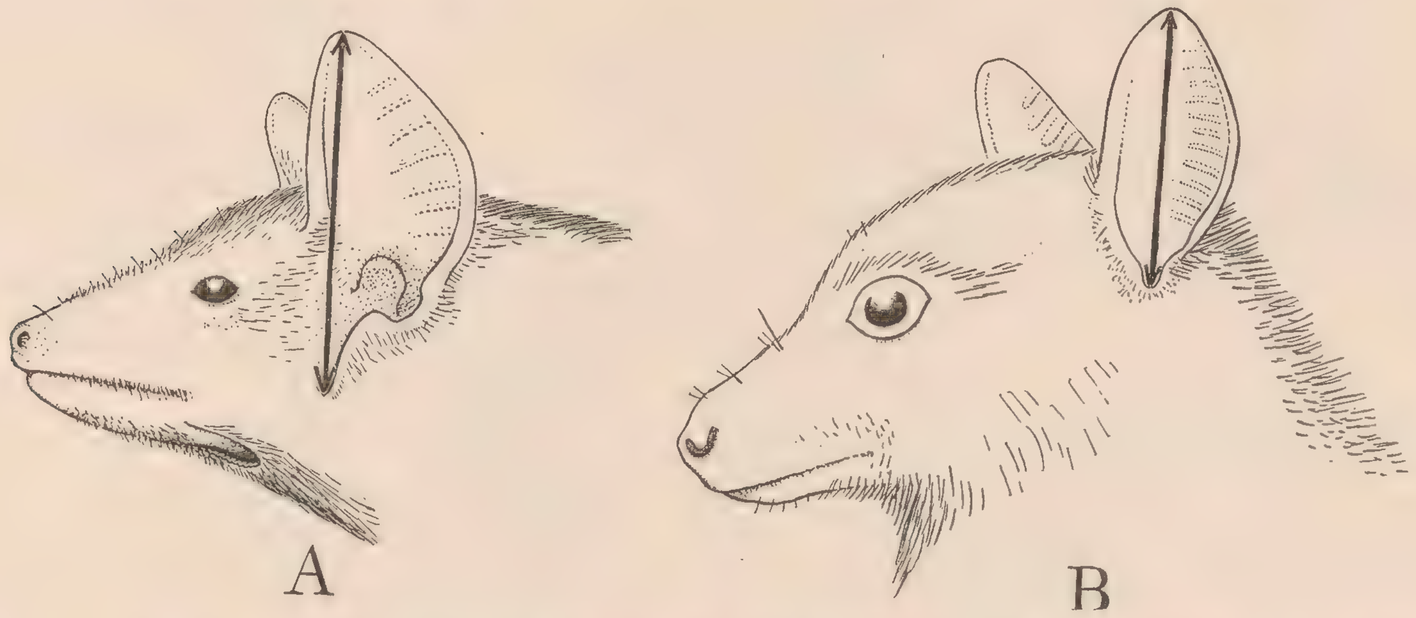


Fig. 1. Outline drawings showing how the ear was measured by the collectors. *A. Saccolaimus peli* ($\frac{1}{1}$); *B. Eidolon helvum* ($\frac{2}{3}$).

For convenience of reference, in respect to geographical data, two tabular lists follow, giving (1) a list of the species, the localities at which they were taken, and the number of specimens of each obtained; (2) a list of the localities, with the names of the species and the number of specimens of each species obtained at each.

The length of the ear, given under the heading 'collectors' measurements' in the present paper, was uniformly taken as indicated in the accompanying outline drawings (Fig. 1); namely, from the lowest point of the ear in front of the antitragus to the tip, instead of from the notch behind the antitragus, as this measurement is usually taken. The method employed in the present collection thus gives a greater length for the ear than by the usual method of measuring the ear from the 'notch,' the difference in some species being very considerable and without this explanation might lead to confusion.

The length of the foot, as given in this paper, always includes the claws.

All measurements are in millimeters.

1. *List of Species and Subspecies, giving the Localities at which they were taken and the Number of Specimens from each Locality.*

	Species	Localities	Totals of Specimens
		PTEROPODIDÆ.	
1.	Eidolon helvum (*Kerr*).	Avakubi 50, Medje 4	54
2.	Epomops franqueti franqueti (*Tomes*).	Avakubi 6, Medje 12, Leopoldville 1, Niapu 1, Niangara 1, Stanleyville 2, Vankerckhovenville 1	24
3.	Hypsignathus monstrosus *H. Allen*.	Avakubi 19, Stanleyville 4, Bafwabaka 6, Penge 1	30
4.	Epomophorus anurus *Heuglin*.	Faradje 24	24
5.	" wahlbergi haldemani (*Hallowell*).	Cape Lopez 1	1
6.	Micropteropus pusillus (*Peters*).	Niangara 1	1
7.	Casinycteris argynnis (*Thomas*).	Medje 1	1
8.	Myonycteris wroughtoni *Andersen*.	Medje 4	4
		EMBALLONURIDÆ.	
9.	Taphozous mauritianus *Geoffroy*.	Niangara 2, Faradje 41, Avakubi 3, Garamba 1, Yakuluku 1	48
10.	" sudani *Thomas*.	Dungu 11	11
11.	Saccolaimus peli (*Temminck*).	Avakubi 4, Ngayu 3, Bafwabaka 1, Medje 4, Niangara 4, Rungu 1	17
12.	Colëura gallarum nilosa *Thomas*.	Aba 9	9

	Species	Localities	Totals o Specimen
	NYCTERIDÆ.		
13.	Nycteris hispida *Schreber*.	Boma 3, Stanleyville 4, Avakubi 3, Medje 1	11
14.	“ pallida sp. nov.	Faradje 8, Vankerckhovenville 4	12
15.	“ avakubia sp. nov.	Avakubi 1	1
16.	“ arge (*Thomas*).	Avakubi 8, Medje 2, Niangara 2	12
17.	“ major (*Andersen*).	Garamba 1, Faradje 1	2
	MEGADERMIDÆ.		
18.	Lavia frons affinis *Andersen and Wroughton*.	Faradje 25	25
	RHINOLOPHIDÆ.		
19.	Rhinolophus hildebrandti eloquens *Andersen*.	Aba 3	3
20.	Rhinolophus abæ sp. nov.	Aba 10	10
21.	“ axillaris sp. nov.	Aba 5	5
22.	Hipposideros caffer centralis *Andersen*.	Leopoldville 1, Avakubi 14, Medje 12, Niangara 2, Faradje 4, Poko 3, Aba 3	39
23.	“ caffer niapu subsp. nov.	Niapu 10	10
24.	“ abæ sp. nov.	Aba 35	35
25.	“ nanus sp. nov.	Faradje 1	1
26.	“ langi sp. nov.	Avakubi 4, Niangara 2, Medje 7, Niapu 1	14
27.	“ gigas niangaræ subsp. n.	Niangara 1	1
	VESPERTILIONIDÆ.		
28.	Myotis bocagii bocagii (*Peters*).	Leopoldville 1	1
29.	“ “ cupreolus (*Thomas*).	Bafwabaka 11, Medje 3	14
30.	“ “ hildegardeæ (*Thomas*).	Aba 11, Faradje 2	13
31.	Pipistrellus nanus (*Peters*).	Stanleyville 6, Risimu 1, Ngayu 4, Bafwabaka 30, Gamangui 1, Medje 6, Niangara 9, Faradje 7, Yakuluku 1, Poko 1, Garamba 1	67
32.	“ abaensis sp. nov.	Aba 3	3
33.	“ musciculus *Thomas*.	Avakubi 1	1
34.	Scotozous rüppelii (*Fischer*).	Poko 1	1
35.	Eptesicus tenuipinnis (*Peters*).	Ngayu 7	7
36.	“ ater sp. nov.	Faradje 2, Niangara 2	4

	Species	Localities	Totals of Specimens
37.	Eptesicus faradjius sp. nov.	Faradje 14, Niangara 10	24
38.	" minutus minutus (*Temminck*).	Niangara 1, Isiro 1	2
39.	" garambæ sp. nov.	Garamba 1	1
40.	Mimetillus moloneyi (*Thomas*).	Stanleyville 1, Medje 2, Avakubi 1	4
41.	Scoteinus schlieffenii (*Peters*).	Niangara 1	1
42.	Pachyotus altilis (*G. M. Allen*).	Faradje 2.	2
43.	" nigrita nux (*Thomas*).	Medje 2	2
44.	Glauconycteris papilio (Thomas).	Niangara 4, Faradje 13, Aba 3	20
45.	" humeralis sp. nov.	Medje 4, Avakubi 1	5
46.	" alboguttatus sp. n.	Medje 1	1
47.	Miniopterus breyeri vicinior subsp. nov.	Aba 17	17
48.	" inflatus *Thomas*.	Thysville 13	13
49.	Kerivoula cuprosa *Thomas*.	Medje 1, Akenge 2	3

MOLOSSIDÆ.

	Species	Localities	Totals of Specimens
50.	Myopterus albatus (*Thomas*).	Niangara 7	7
51.	Nyctinomus ansorgei *Thomas*.	Faradje 26	26
52.	" leonis *Thomas*.	Panga 1, Medje 1	2
53.	" cisturus *Thomas*.	Niangara 1	1
54.	" ochraceus sp. nov.	Medje 22	22
55.	Chærephon frater sp. nov.	Malela 22	22
56.	" russatus sp. nov.	Medje 27	27
57.	" sp. indet.	Avakuba 1	1
58.	" (Lophomops) chapini sp. nov.	Faradje 2	2
59.	" " cristatus sp. nov.	Boma 4	4
60.	" " abæ sp. nov.	Aba 25, Faradje 4	29
61.	Mops midas (Sundevall).	Faradje 6	6
62.	" congicus sp. nov.	Medje 15	15
63.	" niangaræ sp. nov.	Niangara 1	1
64.	" trevori sp. nov.	Faradje 1	1
65.	" (Allomops) osborni sp. nov.	Kinshasa 2	2
66.	" " occipitalis sp. nov.	Avakubi 1, Medje 6	7
67.	" " faradjius sp. nov.	Faradje 1	1
68.	" " nanulus sp. nov.	Niangara 7	7

2. *List of Localities,*[1] *with Names of the Species and Subspecies, and Number of Specimens taken at each Locality.*

Localities	Species	No. of Specimens	Totals
Aba	Colëura gallarum nilosa	9	
"	Rhinolophus hildebrandti eloquens	3	

---

[1] The geographical position of the localities is shown on the accompanying map (p. 415).

Localities	Species	No. of Specimens	Totals
Aba	Rhinolophus abæ	10	
"	" axillaris	5	
"	Hipposideros caffer centralis	3	
"	" abæ	35	
"	Myotis bocagii hildegardeæ	11	
"	Pipistrellus abaensis	3	
"	Glauconycteris papilio	3	
"	Miniopterus breyeri vicinior	17	
"	Chærephon (Lophomops) abæ	25	124
Akenge	Kerivoula cuprosa	2	2
Avakubi	Eidolon helvum	50	
"	Epomops franqueti franqueti	6	
"	Hypsignathus monstrosus	19	
"	Taphozous mauritianus	3	
"	Saccolaimus peli	4	
"	Nycteris hispida	3	
"	" avakubia	1	
"	" arge	8	
"	Hipposideros caffer centralis	14	
"	" langi	4	
"	Pipistrellus musciculus	1	
"	Mimetillus moloneyi	1	
"	Glauconycteris humeralis	1	
"	Mops (Allomops) occipitalis	1	
"	Chærephon sp. indet.	1	117
Bafwabaka	Hypsignathus monstrosus	6	
"	Saccolaimus peli	1	
"	Myotis bocagii cupreolus	11	
"	Pipistrellus nanus	30	48
Boma	Nycteris hispida	3	
"	Chærephon (Lophomops) cristatus	4	7
Cape Lopez	Epomophorus wahlbergi haldemani	1	1
Dungu	Taphozous sudani	11	11
Faradje	Epomophorus anurus	24	
"	Taphozous mauritianus	41	
"	Nycteris pallida	8	
"	" major	1	
"	Lavia frons affinis	25	
"	Hipposideros caffer centralis	4	
"	" nanus	1	
"	Myotis bocagii hildegardeæ	2	
"	Pipistrellus nanus	7	
"	Eptesicus ater	2	
"	" faradjius	14	
"	Pachyotus altilis	2	
"	Glauconycteris papilio	13	
"	Nyctinomus ansorgei	26	

Localities	Species	No. of Specimens	Totals
Faradje	Chærephon (Lophomops) chapini	2	
"	" " abæ	4	
"	Mops midas	6	
"	" faradjius	1	
"	" trevori	1	184
Gamangui	Pipistrellus nanus	1	1
Garamba	Taphozous mauritianus	1	
"	Nycteris major	1	
"	Pipistrellus nanus	1	
"	Eptesicus garambæ	1	4
Isiro	Eptesicus minutus	1	1
Kinshasa	Mops (Allomops) osborni	2	2
Leopoldville	Epomops franqueti franqueti	1	
"	Hipposideros caffer centralis	1	
"	Myotis bocagii bocagii	1	3
Malela	Chærephon frater	22	22
Medje	Eidolon helvum	4	
"	Epomops franqueti franqueti	12	
"	Casinycteris argynnis	1	
"	Myonycteris wroughtoni	4	
"	Saccolaimus peli	4	
"	Nycteris hispida	1	
"	" arge	2	
"	Hipposideros caffer centralis	12	
"	" langi	7	
"	Myotis bocagii cupreolus	3	
"	Pipistrellus nanus	6	
"	Mimetillus moloneyi	2	
"	Pachyotus nigrita nux	2	
"	Glauconycteris humeralis	4	
"	" alboguttatus	1	
"	Kerivoula cuprosa	1	
"	Nyctinomus leonis	1	
"	" ochraceus	22	
"	Chærephon russatus	27	
"	Mops congicus	15	
"	" (Allomops) occipitalis	6	137
Ngayu	Saccolaimus peli	3	
"	Pipistrellus nanus	4	
"	Eptesicus tenuipinnis	7	14
Niangara	Epomops franqueti franqueti	1	
"	Micropteropus pusillus	1	
"	Taphozous mauritianus	2	
"	Saccolaimus peli	4	
"	Nycteris arge	2	
"	Hipposideros caffer centralis	2	
"	" langi	2	

Localities	Species	No. of Specimens	Totals
Niangara	Hipposideros gigas niangaræ	1	
“	Pipistrellus nanus	9	
“	Eptesicus ater	2	
“	“ faradjius	10	
“	“ minutus	1	
“	Scoteinus schlieffeni	1	
“	Glauconycteris papilio	4	
“	Myopterus albatus	7	
“	Nyctinomus cisturus	1	
“	Mops niangaræ	1	
“	“ (Allomops) nanulus	7	58
Niapu	Epomops franqueti franqueti	1	
“	Hipposideros caffer niapu	10	
“	“ langi	1	12
Panga	Chærephon leonis	1	1
Penge	Hypsignathus monstrosus	1	1
Poko	Hipposideros caffer centralis	3	
“	Pipistrellus nanus	1	
“	Scotozous rüppelii	1	5
Risimu	Pipistrellus nanus	1	1
Rungu	Saccolaimus peli	1	1
Stanleyville	Epomops franqueti franqueti	2	
“	Hypsignathus monstrosus	4	
“	Nycteris hispida	4	
“	Pipistrellus nanus	6	
“	Mimetillus moloneyi	1	17
Thysville	Miniopterus inflatus	13	13
Vankerckhovenville	Epomops franqueti franqueti	1	
“	Nycteris pallida	4	5
Yakuluku	Taphozous mauritianus	1	
“	Pipistrellus nanus	1	2

3. *New Species and Subspecies, with their Type Localities.*

1. *Nycteris pallida.* Faradje.
2. “ *avakubia.* Avakubi.
3. *Rhinolophus abæ.* Aba.
4. “ *axillaris.* Aba.
5. *Hipposideros caffer niapu.* Niapu.
6. “ *abæ.* Aba.
7. “ *nanus.* Faradje.
8. “ *langi.* Avakubi.
9. “ *gigas niangaræ.* Niangara.
10. *Pipistrellus abaensis.* Aba.
11. *Eptesicus ater.* Faradje.
12. “ *faradjius.* Faradje.
13. “ *garambæ.* Garamba.

14. *Glauconycteris humeralis.* Medje.
15. “ *alboguttatus.* Medje.
16. *Miniopterus breyeri vicinior.* Aba.
17. *Nyctinomus ochraceus.* Medje.
18. “ *frater.* Malela.
19. *Chærephon russatus.* Medje.
20. “ *(Lophomops) chapini.* Faradje.
21. “ “ *cristatus.* Boma.
22. “ “ *abæ.* Aba.
23. *Mops congicus.* Medje.
24. “ *niangaræ.* Niangara.
25. “ *trevori.* Faradje.
26. “ *(Allomops) osborni.* Kinshasa.
27. “ “ *occipitalis.* Avakubi.
28. “ “ *faradjius.* Faradje.
29. “ “ *nanulus.* Niangara.

GENERAL SUMMARY.

Families	Genera	Species and Subspecies	Specimens	Localities[1]
Pteropidæ	7	8	140	11
Emballonuridæ	3	4	87	10
Nycteridæ	1	5	37	8
Megadermidæ	1	1	25	1
Rhinolophidæ	2	9	118	9
Vespertilionidæ	10	23	206	17
Molossidæ	4	19	183	9
	28	69	796	

MEGACHIROPTERA.

PTEROPODIDÆ.

1. **Eidolon helvum** (*Kerr*).

Plate XLIV, Fig. 3.

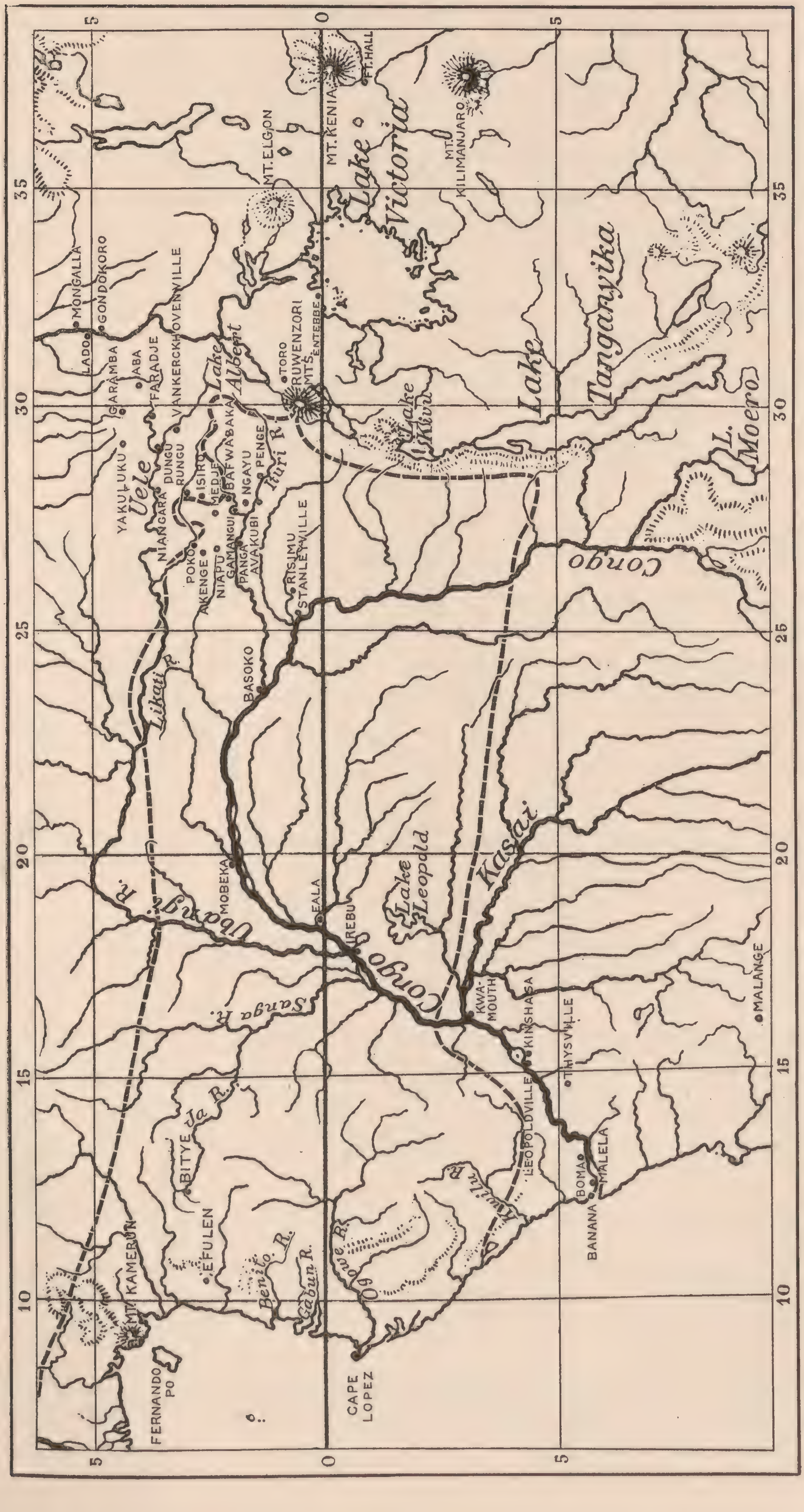
Vespertilio vampyrus helvus KERR, Anim. Kingd., I, 1792, p. 91, No. 108.

Eidolon helvum ANDERSEN, Cat. Chirop., ed. 2, I, p. 8, 1912. Type locality, Senegal (Andersen).

Fifty-four specimens (33 males, 21 females), collected as follows: Avakubi, 50, Nov. 20, 1909, Sept. 9, Oct. 1, 1913, May 14–16, June 5, 1914; Medje, 4, June 6, May 20–22, 1914. Thirty-seven of the Avakubi specimens

---

[1] The total number of localities at which bats were collected is 27.



Map of the Congo and Lake Region of Africa, showing all the localities where bats were collected by the Congo Expedition, as well as others mentioned in the present paper. The limits of the West African rain forest are indicated by a broken line.

were taken in one day, Nov. 20, 1909. Of the males 23 are adult and 10 immature; of the females 8 are adult and 13 immature. There are no very young specimens. About 6 specimens are in alcohol, the others being skins with skulls.

There is practically no sexual difference in size and very little in color. Young of the year are paler than adults, especially on the ventral surface, and lack the tawny color on the foreneck.

Collectors' measurements (20 adult males, 8 adult females):

	Head and body	Tail	Foot	Ear
♂	204 (192–214)	12 (6–20)	34 (31–37)	31 (29–33)
♀	207 (194–215)	14.5 (10–19)	33.5 (32–35)	31.8 (30–33)

Measurements of Skull and Forearm in 21 Males.[1]

Cat. No.	Length	Zygom. breadth	Maxill. toothrow	Palatal length	Palatal breadth	Forearm
48663	56	——	18.4	28	18	126
48665	55	31	17.3	28.3	17	119
48670	53.8	33.6	17	27.8	17.4	120
48671	53.7	32.6	18	27.6	17	122
48672	53	33.5	17	27.8	17	118
48674	55	32.7	18	29.7	17.2	126
48675	52.3	32	17	27	16.5	115
48677	55	34.2	18	27.8	17	122
48681	56	34	18.3	29	17.5	124
48682	54.5	33	18	28	16	123
48685	52	33.2	18	27	16.8	120
48687	52	33.2	17	25.2	17	115
48688	52.5	33.2	16.6	26.8	16.5	115
48689	51.5	32.3	17.2	26.8	16.5	115
48690	54.7	33	17.8	27.6	16	123
48691	54	——	17.3	28	17	114
48693	54	——	18.3	27.8	17.6	120
48696	53	32	17.2	27	15.8	119
48697	51.5	32.3	16.8	26.2	17.3	116
48704	53.6	32	18	27.3	18	123
48706	58	34.8	19	30	18	121
Average	54.2	32.8	17.7	28.1	17.5	119
Minimum	51.5	31	16.6	25.2	15.8	114
Maximum	58	34.8	19	30	18	126

---

[1] *Explanation of measurements.*— Length = front border of premaxillaries to posterior border of occipital condyles; palatal length = posterior border of palatal foramina to posterior palatal border; palatal breadth = outside to outside of last upper molars.

Measurements of Skull and Forearm in 6 Females.[1]

Cat. No.	Length	Zygom. breadth	Maxill. toothrow	Palatal length	Palatal breadth	Forearm
48664	53	33	17	27	17	123
48668	54	33	17	26.3	17.1	119
48673	54	33	16.6	28	17	125
48680	55	34	17.5	27	17.1	127
48683	52.5	31	18	27	17.5	122
48705	54.1	31.8	17.1	27	16.2	123
Average	53.8	32.6	17.2	27.5	17	123
Minimum	52.5	31	16.6	26.3	16.2	119
Maximum	55	34	18	28	17.5	127

In all the skulls except one (No. 48665, ♂) the bones of the skull are completely fused; in this the nasal sutures are still open, yet this skull, judging by other features, is one of the oldest of the series. In cranial measurements the sexes are similar, but the small series of females indicates a greater length of forearm than in the males, an apparent difference that would probably disappear in a larger series. The cranial measurements of males and females are practically the same.

2. **Epomops franqueti franqueti** (*Tomes*).

Plate XLIV, Fig. 2; Plate XLV.

Epomophorus franqueti Tomes, Proc. Zool. Soc. London, 1860, p. 54, pl. lxxv. Gaboon.

Twenty-four specimens (20 skins, 4 in alcohol), collected as follows: Leopoldville, 1; Niangara, 1; Medje, 12; Vankerckhovenville, 1; Avakubi, 6; Stanleyville, 2; Niapu, 1. Most of the specimens are immature, only 10 (4 males, 6 females) being fully adult. Fourteen are sexed as males, 10 as females.

Collectors' measurements (3 adult males, 4 adult females):

	Total length	Tail	Foot	Ear
♂	171 (160–178)	0	26 (24–28)	28.3 (28–29)
♀	154 (150–157)	0	24 (23–25)	26.5 (25–27)

---

[1] Measurements as in preceding table.

Measurements of Skull and Forearm in 3 Males and 5 Females.[1]

Cat. No.	Sex	Length	Zygom. breadth	Maxill. toothrow	Palatal length	Palatal breadth	Forearm
48724	♂	51.4	28.6	11.5	26.4	16	96
48725	♂	51	28	12.1	26.1	15.3	97
48729	♂	52.5	—	11.6	25.6	15.4	—
Average		51.6	28.3	11.7	26.3	15.6	
Minimum		51		11.5	25.6	15.3	
Maximum		52.5		12.1	26.4	16	
48714	♀	44.5	27.3	10.8	22.3	14.7	91
48719	♀	44.4	26.2	10.8	22.5	14.6	87
48721	♀	45	25.5	10.1	21.5	14	92
48723	♀	44.4	27.1	10	21.5	14.2	—
48726	♀	45.8	27.2	11.4	22.4	14	88
Average		44.9	26.6	10.6	22	14.3	89
Minimum		44.4	25.5	10	21.5	14	87
Maximum		45.8	27.3	11.4	22.5	14.7	92

As shown above, the males considerably exceed the females in size. In two of the adult males the shoulder tufts are white, in the other deep yellow. There is a wide range of color variation, due apparently to differences in age. In one of the females (No. 48723) there is a minute premolar in front of p^3, and another female (No. 48719) has four upper incisors, probably the outer pair retained from the milk dentition.

3. **Hypsignathus monstrosus** *H. Allen.*

Plate XLIV, Fig. 4; and Text Figs. 2 and 16 (p. 485), 18–20 (pp. 503, 506, 507).

Hypsignathus monstrosus H. Allen, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 157. West Africa (= Gaboon).

Thirty specimens (26 skins, 4 in alcohol), collected as follows: Avakubi, 19; Stanleyville, 4; Bafwabaka, 6; Penge, 1. Adult males, 10; adult females, 4; immature specimens, 16.

Collectors' measurements (9 adult males, 4 adult females):

	Head and body	Tail	Foot	Ear
♂	253 (248–260)	0	38 (36–40)	36 (35–39)
♀	203 (198–210)	0	35 (33–36)	33 (31–34)

Expanse of wing, two males, 950 and 967; one female, 840.

---

[1] Measurements as in preceding tables.

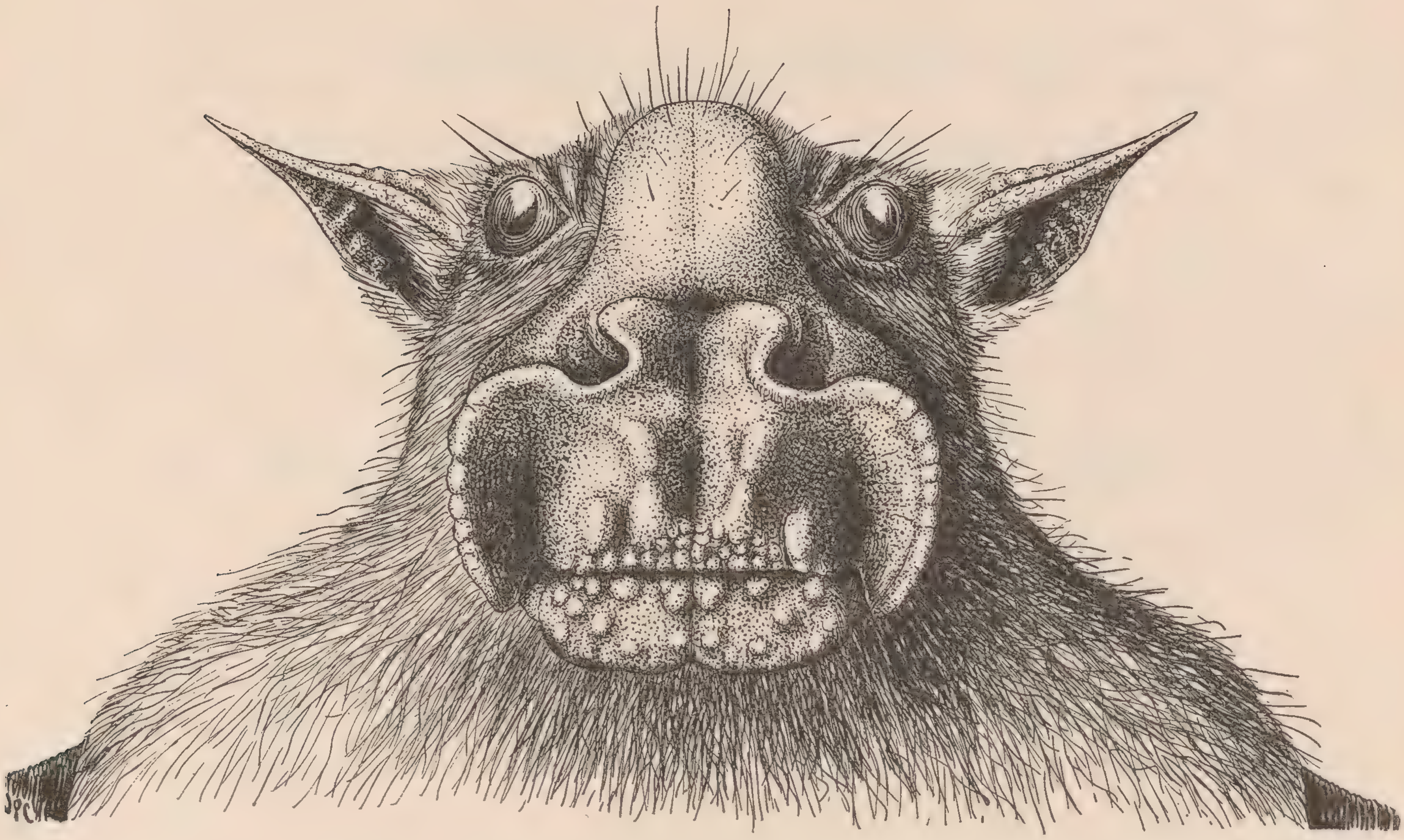


Fig. 2. *Hypsignathus monstrosus.* Direct front view of head, adult male, from a freshly killed specimen. $\frac{1}{1}$.

See also Text Figs. 16 and 18 (pp. 485 and 503) for illustrations, respectively, of head and cheek-pouches, and Text Figs. 19 and 20 (pp. 506 and 507) for laryngeal and visceral anatomy.

Measurements of Skull and Forearm in 10 adult Males and 4 adult Females.

Cat. No.	Sex	Condylo-basal length	Zygom. breadth	Upper pm-m. series	Palatal length	Palatal breadth	Forearm
48629	♀	61	32.5	13.8	30	19	123
48652	♀	60	33.3	13.5	30	18.4	121
48628	♀	60	32.5	14	30	17.8	121
48636	♀	60	33	14.8	30.6	19	118
48637	♂	72	36.4	15	36.3	21.4	134
48638	♂	73.5	37	16	38.5	23.3	137
48639	♂	70.3	37	16.7	36.2	22	132
48640	♂	71.8	37	15.7	37	22	134
48641	♂	71	37.3	15.5	35.3	21.2	137
48642	♂	70.5	37.3	15.3	36	23	131
48648	♂	72	37.5	15.8	36	22.4	133
48649	♂	73.2	38.6	16	37	23	133
48653	♂	70.8	35.6	15.6	36	21.8	—
48654	♂	72.5	36.8	16	36	22.3	131
Average	10♂	71.8	37	15.8	36.5	22	133
Minimum		70.3	35.6	15	36	21.2	131
Maximum		73.5	38.6	16.7	38.5	23.3	137
Average	4♀	60.2	32.8	14.2	30.2	19.5	121

The females in this species are much smaller than the males.

4. **Epomophorus anurus** *Heuglin.*

Plate XLIV, Fig. 1; Plates XLVI, XLVII.

Epomophorus anurus Heuglin, N. Act. Ac. Cæs. Leopold., XXXI, Abh. viii, 1864, p. 12. Bongo, Bahr-el-Ghazel, Sudan.

Twenty-four specimens (20 skins, 4 in alcohol), all collected at Faradje, Sept.–Oct., 1912. Males, 10, females, 14; only 12 specimens are adult. Only 5 of the males have shoulder tufts, which are well developed in only 3.

Collectors' measurements (5 males, 6 females):

	Head and body	Foot	Ear
♂	139 (135–145)	23.5 (22–25)	23.6 (23–25)
♀	129 (125–135)	21.3 (21–24)	22.5 (21–25)

For 2 adult females the length of the tail is given as, respectively, 2 and 3 mm.; in 3 immature females as, respectively, 2, 6, 2 mm.

Measurements of Skull and Forearm in 5 Males and 6 Females.

Cat. No.	Sex	Condylo-basal length	Zygom. breadth	Upper pm-m. series	Palatal length	Palatal breadth	Forearm
48733	♂	46.4	24.9	——	27	12.6	76
48734	♂	48.2	23.6	11	28.1	13.1	77
48738	♂	45.8	26.7	11.8	26	13.2	76
48750	♂	46.8	24.9	9.6	27.1	12.5	77
48761	♂	46.5	25	10.7	26.9	13.1	76
Average	♂	46.7	24.6	10.8	27	12.9	76.4
Minimum	♂	45.8	23.6	9.6	26	12.5	76
Maximum	♂	48.2	25	11.8	28.1	13.2	77
48735	♀	41.6	23.2	9.7	23.7	12.2	75
48732	♀	42.1	22.7	9.7	23.5	11.6	71
48739	♀	43.8	23.9	9.9	24.5	13.1	73
48740	♀	42	22.9	9.9	23.8	12.1	74
48741	♀	41.6	22	9.8	23	12.1	74
48744	♀	40.9	22.6	9.8	22.8	11.4	72
Average	♀	42	22.9	9.8	23.5	12.1	73
Minimum	♀	40.9	22	9.7	22.8	11.4	72
Maximum	♀	43.8	23.9	9.9	24.6	13.1	75

This series presents a wide range of color variation, the palest, a female, being pale ochraceous buff, while another female and one male are also much paler than the average. In quite a number of the younger specimens the wing membranes are distinctly barred with dark bands, in one or two strongly so.

This series extends the known range of *Epomophorus anurus* somewhat to the westward of records given by Andersen (Uganda and Ruwenzori).

5. **Epomophorus wahlbergi haldemani** (*Hallowell*).

Pteropus haldemani HALLOWELL, Proc. Acad. Nat. Sci. Philadelphia, 1846, p. 52. West Africa.

One specimen (No. 48662), Cape Lopez, Feb. 10, 1915, an adult male with small shoulder tufts.

Collectors' measurements: Total length (head and body), 345; foot, 25; ear, 23.

Skull and forearm: Condylobasal length, 49.2; zygomatic breadth, 26.5; upper premolar-molar series, 11.5; palatal length ("palation to incisive foramina"), 26.1; outside to outside of crowns of m^1 (maxillar breadth), 14.3; forearm, 81.

6. **Micropteropus pusillus** (*Peters*).

Epomophorus pusillus PETERS, Monatsb. Akad. Berlin, 1867, p. 870. Yoruba, southwestern Nigeria.

One specimen, subadult male, skin and skull, Niangara, Nov. 18, 1910.

Forearm, 45; foot, 15; ear, 14; length of skull, 24; mandible, 18.

7. **Casinycteris argynnis** *Thomas.*

Casinycteris argynnis THOMAS, Ann. and Mag. Nat. Hist. (8), VI, p. 111, July, 1910. Bitye, Ja River, S. E. Cameroons. Altitude 2000 feet.

One specimen (No. 48751), adult female, skin and skull, Medje, April 22, 1910.

Collectors' measurements: Total length, 92; tail, 0; hind foot, 15; ear, 17. Forearm (from skin), 60.

Skull, total length, 26; condylobasal length, 24.5; zygomatic breadth, 19; mastoid breadth, 12; maxillar breadth, 10; interorbital breadth, 5.2; breadth at base of canines, 5.5; maxillary toothrow (including canine), 7.8; length of mandible, 19.4; height at coronoid, 8.7; mandibular toothrow (including canine), 9.6.

8. **Myonycteris wroughtoni** *K. Andersen.*

Myonycteris wroughtoni ANDERSEN, Cat. Chirop. Br. Mus., I, 1912, p. 580. Likati River, Welle district, N. E. Congo.

Four specimens: 1 adult male, 2 adult females, 1 half-grown young, Medje, April 4, 16, and Sept. 6, 1914.

The three adults are slightly smaller than the measurements given by Andersen of the male type and male paratype, although the teeth in the Medje specimens are considerably worn, indicating full maturity. The forearm averages 4 mm. shorter, with all other wing measurements in proportion. The skull measurements are also slightly less, averaging about 1 mm. shorter, and the zygomatic breadth is fully 1 mm. less, with other skull measurements proportionally smaller. The neck ruff in the male is also dull yellow orange instead of "tawny olive." One of the females (taken April 16) has the upperparts vandyke brown, a little lighter across the neck and on the head than the back. The male (taken April 4) is much lighter, the upperparts being light brown with a faint suffusion of cinnamon buff, lighter on the head and hindneck. The other adult female, taken September 6, hanging in a bush with the young one, has the upperparts tawny, the head and shoulders a little lighter than the back, and is thus very different in color from the young one taken with her, and from the other adult female taken in April. These color differences may be in part seasonal, or merely individual.

Collectors' measurements: Head and body, ♂ 130, ♀ 114, ♀ 162; tail, ♂ 4, ♀ 12, ♀ 6; foot, ♂ 18, ♀ 18, ♀ 22; ear, ♂18, ♀ 19, ♀ 20.

Measurements of Skull and Forearm.

Cat. No.	Sex	Length	Zygom. breadth	Upper teeth (c–m^2)	Lower teeth (c–m_3)	Palatal length	Across m^3–m^3 outside	Forearm
48755	♂	33.7	——	12.7	13.5	16.6	9.8	60.7
48752	♀	32.9	20	12.7	14.5	16	10.1	61
48754	♀	33.6	19.8	12	13.7	16.7	9.2	64
Type[1]	♂	34	21	13	14.5	16.5	10.2	67
Paratype[1]	♂	——	——	13.8	14.5	16.8	10.4	65

[1] From Andersen (*l. c.*, pp. 583–584), for comparison.

MICROCHIROPTERA.

EMBALLONURIDÆ.

9. **Taphozous mauritianus** *Geoffroy.*

Plate XLVIII, Fig. 1.

Taphozous mauritianus E. Geoffroy, Descrip. de l'Egypte, II, 1813, p. 127. Ile de France.

Forty-eight specimens (36 skins, 12 alcoholics), collected as follows: Niangara, 2 (skins), Nov. 18–25, 1910; Faradje, 41 (34 skins, 7 alcoholics), Feb. 6, April 1, May 17–28, June 7, July 11, 1911, and Oct. 22–26, Nov. 12–19, Dec. 7–16, 1912; Avakubi, 3 (in alcohol); Garamba and Yakuluku, 1 each (in alcohol).

Collectors' measurements (6 adult males, 10 adult females):

	Total length	Head and body	Tail	Foot	Ear
♂	104 (100–109)	82.5 (80–87)	22 (20–26)	13.2 (12–14)	18.2 (17–19)
♀	106.5 (102–109)	81.6 (77–89)	23.9 (22–26)	13.8 (12–14)	18.2 (17–22)

Forearm, same specimens, ♂ 60.5 (59–62), ♀ 62 (58–65.6).

Skull, same specimens: Total length, ♂ 21.8 (21.3–22.5), ♀ 21.6 (20.6–22.5); zygomatic breadth, ♂ 12.4 (12.2–13.1), ♀ 13 (12–13.8).

The females in the present series slightly exceed the males in size, but the sexes are not distinguishable on the basis of either size or color. The slight range of color variation seems to be correlated with wear and fading, the white tips of the hairs becoming shorter and less conspicuous through abrasion prior to the moult.

10. **Taphozous sudani** *Thomas.*

Taphozous sudani Thomas, Ann. and Mag. Nat. Hist. (8), XV, p. 561, June, 1915. Mongalla, Sudan, "just north of Lado," Upper Nile.

Eleven specimens, 3 skins and skulls and 8 in alcohol, Dungu, March 1, 1913.

Collectors' measurements (2 females, 1 male), total length, 109 (105–111); head and body, 80.7 (78–82); tail, 28 (27–29); foot, 15 (all 15; 13–14 in dry skin); ear, 19.7 (19–20): Forearm, same specimens (from skins), 64.6 (63.6–65.4). Skull, total length, 20.3 (19.6–21); condylobasal length, 19.4 (19–19.7); zygomatic breadth, 12.3 (12.2–12.4). Forearm in 8 alcoholic specimens (4 males, 4 females), ♂ 64.4 (63.6–65), ♀ 65.2 (65.1–65.3).

11. **Saccolaimus peli** (*Temminck*).

Plate XLIX, and Text Fig. 16.

Taphozous peli Temminck, Esquiss. Zool. sur la Côte de Guiné, 1853, p. 82. Gold Coast.

Seventeen specimens (7 males, 10 females, all adult), collected as follows: Avakubi, 4 (including 1 alcoholic), Nov. 16, Dec. 18, 1909, Jan. 15–17, 1914; Ngayu (near Avakubi), 3, Dec. 18, 1909; Bafwabaka, 1, Dec. 28, 1909; Medje, 4, Jan. 14–19, 1910; Niangara, 4, May 27–31, 1913; Rungu, 1, June 28, 1913.

Collectors' measurements (6 adult males, 10 adult females):

	Total length	Head and body	Tail	Foot	Ear
♂	139 (130–149)	109 (103–116)	29.8 (27–33)	25 (23–27)	26.5 (25–29)
♀	145 (135–157)	115 (104–126)	30.6 (26–39)	24.8 (22–26)	25.3 (22–30)

Forearm (same specimens), ♂ 88.2 (86.5–94.5), ♀ 88.1 (83.5–92).

Skull (4 males, 8 females): Total length, ♂ 30.4 (29.8–31), ♀ 30.5 (29.8–31); zygomatic breadth, ♂ 20.1 (18–21), ♀ 20.9 (19.3–21.8).

In external measurements the males average somewhat smaller than the females, particularly in size of body and length of forearm, while the skull measurements are practically the same. The coloration is remarkably constant throughout the series.

The folding of the tip of the wing is illustrated in Part II, p. 515, Fig. 21.

12. **Colëura gallarum nilosa** *Thomas*.

Colëura gallarum nilosa Thomas, Ann. and Mag. Nat. Hist. (8), XV, p. 577, June, 1915. Near mouth of Bahr-el-Zeraf, White Nile.

Nine specimens, skins and skulls, Aba, Dec. 16, 1911.

Collectors' measurements (6 adults): Total length, 76 (71–79); head and body, 60 (55–63); tail, 16 (14–17); foot, 11.5 (10–12); ear, 16 (15–17).

Forearm (same specimens, from skins), 49.3 (47.3–51). Four skulls (from same), total length, 16.3 (15.8–16.7); condylobasal length, 15.5 (15–15.8); breadth of braincase, 7.7 (7.2–8).

NYCTERIDÆ.

13. **Nycteris hispida** (*Schreber*).

Vespertilio hispida SCHREBER, Säugeth., I, p. 169, pl. lvi, 1775. Senegal.

Eleven specimens (5 skins, 6 alcoholic), collected as follows: Boma, 3 (alcoholic); Stanleyville, 4 (2 alcoholic); Avakubi, 3 (1 alcoholic); Medje, 1.

Collectors' measurements (1 male, Stanleyville, 3 females, Avakubi): Total length, 99.5 (96–101); head and body, 52 (50–54); tail, 48 (45–50); ear (from outer base), 23 (22–25).

Forearm (6 specimens, Avakubi and Stanleyville), 41.3 (40–43.4).

Skull (3, Avakubi), total length, 17.9 (17.4–18.4); zygomatic breadth, 10.6 (10.5–10.8).

In the 5 skins the upperparts are dark brown (blackish brown on middle of back), underparts brown, ears and membranes blackish brown.

14. **Nycteris pallida** sp. nov.

Type, No. 49144, ♂ ad., Faradje, Belgian Congo, March 1, 1912; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1858.

A pale small form of the *N. hispida* group, differing strongly from typical *hispida* in its pale coloration and also slightly in smaller size.

Above pale brown, the tips of the hairs on the lower back and sides pale fulvous; underparts grayish brown; head back to the ears very pale brown, in strong contrast with the body; a narrow whitish band bordering the nose pad in front and laterally; ears light brown terminally, much paler basally; membranes much paler than in *hispida*.

Collectors' measurements of type: Total length, 92; tail, 45; foot, 10; ear, 21 (in skin from anterior border, 15.5).

Additional measurements from type: Forearm, 39.5; tibia, 19; foot, 9.2. Forearm in 5 alcoholics (Faradje, 3, Vankerckhovenville, 2), 37.8 (36.5–39.5).

Skull (type), total length, 17.4; zygomatic breadth, 10.2; upper toothrow (c–m^3), 6.5; lower jaw, 11.8; lower toothrow, 6.8. Type and three topotypes, total length, 17.2 (16.9–17.4); zygomatic breadth (2 skulls), 10.2 (10.1–10.3).

Represented by 12 specimens (3 skins, 9 alcoholics, part immature), of which 8 are from Faradje, and 4 from Vankerckhovenville.

Present material indicates that *N. pallida* differs from *N. hispida,* its nearest ally, in much paler coloration, including especially the ears and membranes, and smaller size, averaging about 4 mm. less in the length of the forearm, with other measurements proportional. *N. pallida* is thus much smaller than *N. aurita* Andersen.

15. **Nycteris avakubia** sp. nov.

Type (and only specimen, in alcohol), No. 49403, ♂ ad., Avakubi, Belgian Congo, September, 1913; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2623.

A member of the *N. hispida* group, intermediate in size between *N. hispida* and *N. grandis*. Upper incisors trifid, p_4 large, fully one third the size of p_3, and similar to it in general form. Coloration not distinctive, but very dark including ears and membranes, in the single specimen in alcohol.

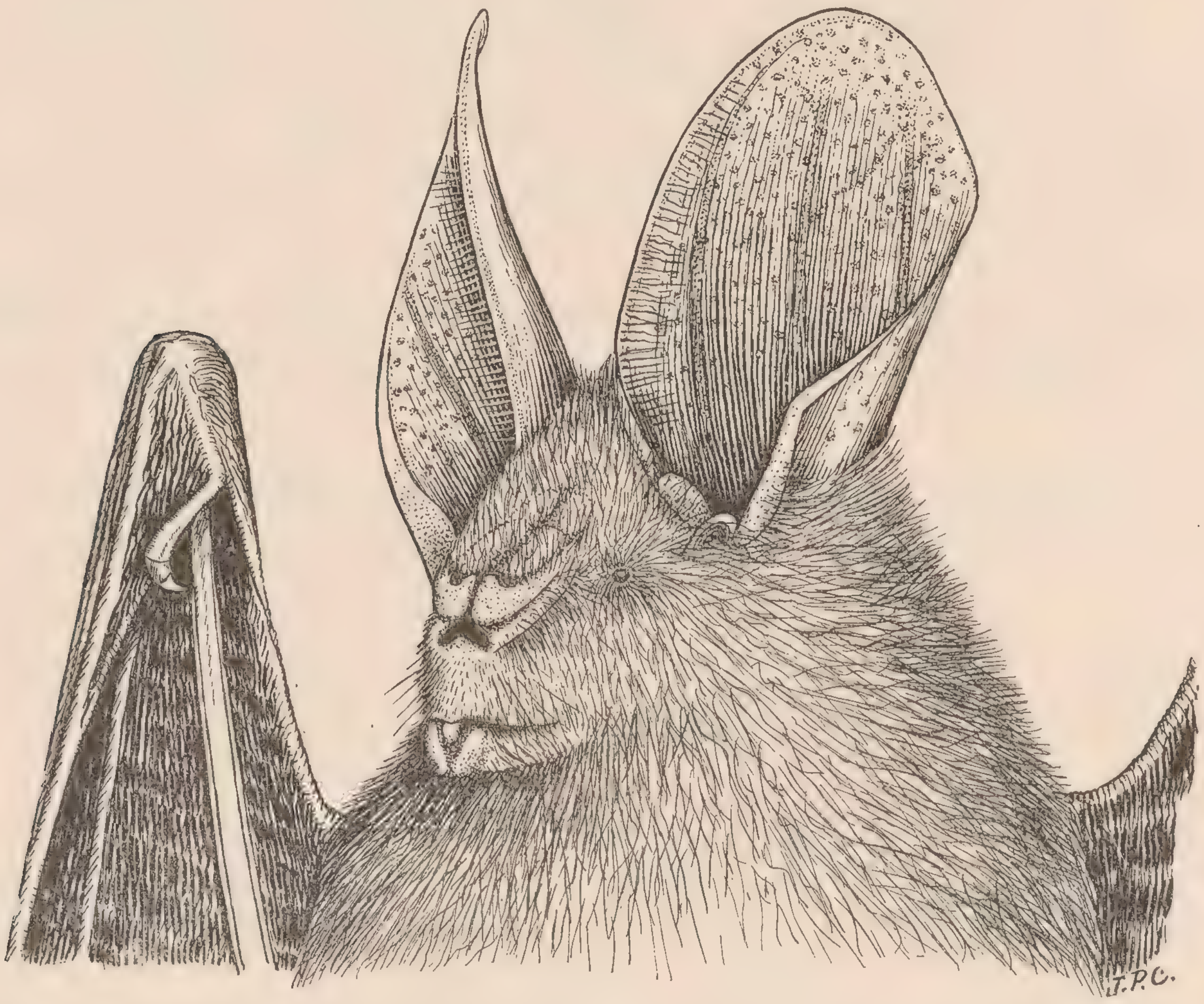


Fig. 3. *Nycteris avakubia*. Head, from field sketch of type, No. 49403, male. $\frac{4}{3}$.

Total length, 137 (150,[1] 144.7); head and body, 63(--, 71); tail, 65 (70, 73.7); ear, 25 (32, 30.5); forearm, 51 (59.5, 57); third finger, metacarp, 40 (44, 43.2); tibia, 30 (25.5, 31.8); foot, 12 (18.5, 15.2); calcaneum, 20 (23, 22.9).

Skull, total length, 22.4; zygomatic breadth, 12.9; upper toothrow (c–m^3), 7.7; length of mandible, 15.1; lower toothrow (c–m_3), 8.4.

Represented only by the type (in alcohol) taken at Avakubi.

16. **Nycteris arge** (*Thomas*).

Petalia arge Thomas, Ann. and Mag. Nat. Hist. (7), XII, p. 633, Dec. 1903. Efulen, Cameroons.

Twelve specimens (4 males, 8 females, all adult, of which 4 are alcoholics), collected as follows: Avakubi, 8 (6 skins, 2 alcoholic), Oct. 13,

---

[1] The first measurements in parenthesis are of *Nycteris grandis* as given by Peters (Monatsb. Akad. Wissens. Berlin, 1866, p. 672) from a specimen in the British Museum; the second are from apparently the same specimen as given by Dobson (Cat. Chiropt. Br. Mus., 1878, p. 164).

Nov. 16–28, 1909, Jan. 28, 1914; Medje, 2 (skins), May 3, 1909; Jan. 16, 1910; Niangara, 2 (alcoholic), March 27, 1913.

Collectors' measurements (2 males, 5 females):

	Total length	Head and body	Tail	Foot	Ear
♂	114 (112–116)	57.5 (56–59)	56.5 (56–57)	10 (10–10)	31 (31–31)
♀	114 (111–117)	56 (51–60)	58 (56–61)	10.4 (10–12)	32 (30–34)

Forearm (same specimens), 42.8 (41.6–43.5). Lower leg and foot (5 Avakubi specimens), 32.5 (32.2–33.5).

Skull (2 males, 5 females), total length, ♂ 19.6 (19.3–19.9); ♀ 20.2 (19.8–20.9); zygomatic breadth, ♂ 11.2 (11.1–11.4); ♀ 11.6 (11.1–12.6).

The following measurements are from 3 alcoholics (Avakubi, 1 ♂, Niangara, 2, ♂ and ♀): Forearm, 43 (41–44.7); third metacarpal, 33.5 (30–36); ear, 25 (23–27).

17. **Nycteris major** (*Andersen*).

Petalia major Andersen, Ann. and Mag. Nat. Hist. (8), X, p. 547, Nov. 1912. Ja River, Cameroons.

Two specimens (alcoholic): Garamba, male, June (1912); Faradje, male, Sept. (1913); both adult.

Forearm, 49.5 (49–50); third metacarpal, 39.3 (37–41); skull (Avakubi specimen), total length, 22.4; zygomatic breadth, 12.9.

So far as can be determined from the brief original description of *P. major* (*l. c.*), these specimens should be referred to it.

MEGADERMIDÆ.

18. **Lavia frons affinis** *Andersen and Wroughton.*

Plate L.

Lavia frons affinis Andersen and Wroughton, Ann. and Mag. Nat. Hist. (7), XIX, p. 140, Feb., 1907. Kaka, White Nile.

Twenty-five specimens (11 males, 14 females, of which 4 are alcoholics), all taken at Faradje, as follows: April 23–26, Nov. 5–15, 1911; Jan. 1, 2, 19, Mch. 26, Sept. 25, Oct. 21, Dec. 3, 15, 29, 1912. Adults, 18; immature, 7.

Collectors' measurements (4 adult males, 8 adult females):

	Head and body	Tail	Foot	Ear
♂	75 (70–80)	0	19 (19–19)	41 (40–42)
♀	75.8 (73–79)	0	19 (18–20)	41.7 (40–43)

Forearm (same specimens), ♂ 57.6, (55–58.8), ♀ 58 (55–61).

Skull (same specimens), total length ♂ 25.1 (25–25.3); ♀ 24.4 (21.3–25.4); zygomatic breadth, ♂ 14.8 (14.4–15.2), ♀ 14.9 (14.4–15.2).

RHINOLOPHIDÆ.

19. **Rhinolophus hildebrandti eloquens** *Andersen.*

Rhinolophus hildebrandti eloquens ANDERSEN, Ann. and Mag. Nat. Hist. (7), XV, p. 74, Jan. 1905. Entebbe, Uganda.

Three specimens, skins and skulls (1 male, 2 females), Aba, Dec. 15–17, 1911.

Collectors' measurements: Total length, 96.3 (91–100); head and body, 67 (65–70); foot, 14.7 (14–17); ear (outer base to tip), 29.3 (29–30).

Forearm (from skin), 56.2 (55–57.5). Skull, total length, 26.8 (26.8–26.9); zygomatic breadth, 13.2 (12.8–13.7). A minute p^2 present on both sides in two skulls, wholly lacking in the other skull.

20. **Rhinolophus abæ** sp. nov.

Type, No. 49113, ♀ ad. (skin and skull), Aba, Uele district, Belgian Congo, Dec. 15, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1756.

General coloration drab-brown, a little darker above than below, the middle of the back slightly darker (blackish brown) than the rest of the upperparts, sides of the shoulders a little lighter. Fur almost uniformly colored from base to tip, the median zone being only slightly lighter than the base and tips.

Ears long and pointed, the anterior border slightly convex (increasingly so apically), the posterior nearly straight (slightly concave toward the apex), the antitragus large and high (vertical depth anteriorly 5–6 mm.). Breadth of horseshoe in skins (when not unduly shrunken), 8.5–9.5 mm. Nose-leaf broad at base (about 6.5 mm.), acutely pointed, and about 6 mm. in length. Sella about 3 mm. broad at base and 4 in height (as nearly as can be judged in softened skins), slightly concave on anterior face, with a posterior extension of about 3 mm., highest in front with a slight median axial depression.

Type, collectors' measurements: Total length, 85; head and body, 63; tail, 24; foot, 12; ear, 24. Forearm (from skin), 52.3; tibia, 20; foot, 11.

Skull (type), total length, 22.9; zygomatic breadth, 11.9; breadth at canines, 5.8; maxillary breadth, 8.1; upper toothrow (front of c–m^3), 7.8; lower jaw (incisors to condyle), 15.1; lower toothrow (c–m_3), 8.8.

Represented by ten specimens, skins and skulls (2 males, 8 females) all collected at Aba, December 15–17, 1911.

Collectors' measurements (1 male,[1] 7 females, all adult):

---

[1] The other male is subadult, and one of the females has measurements that obviously do not belong to it.

Total length	Head and Body	Tail	Foot	Ear
85 (80–89)	61 (57–64)	24 (22–27)	12 (11–13)	22.9 (22–24)

Forearm, same specimens, 53 (50–54). Skull (6 specimens), total length, 23 (21.9–23.6); zygomatic breadth, 11.7 (11.3–12.2); breadth at base of canines (9 specimens), 5.9 (5.6–6.2); maxillar breadth (across front corner of m^3), 8.3 (7.8–8.6). P^2 is present on both sides in 3 skulls, on one side in 2 skulls, and absent on both sides in 4 skulls.

The series is very uniform in coloration; an immature male differs from the others in being lighter and grayer, and is somewhat smaller.

This form appears to be a northern representative of the *Rhinolophus auger* group, of which several forms have been described from the Zambesi region and southward by K. Andersen.[1]

21. **Rhinolophus axillaris** sp. nov.

Plate LI, Fig. 2.

Type, No. 49175, ♂ ad. (skin and skull), Aba, Uele district, Belgian Congo, Dec. 17, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1807.

Apparently a member of the *R. landeri* group. Has two phases, a dark brown and a rufous phase.

Dark phase.— Type, above dark hair-brown with a faint rufescent tone in strong light, the fur dull gray-brown basally, with long hair-brown tips (in some specimens forming a dark broad V-shaped area on the lower back); below much lighter, the fur pale brownish plumbeous basally, the tips darker, giving a pale brownish wash. At the base of each arm is an axillar patch of short, stiff, dark rust-colored hairs, about 4 by 6.5 mm. in area, in strong contrast with the surrounding fur, both in color and texture. Ears and feet pale brown, membranes darker.

Total length (collectors' measurements), 77 mm.; head and body, 52; tail, 23; foot, 11; ear, 18.

Rufous phase.— Above rich cinnamon-brown, the fur basally pale gray, with long dark cinnamon-brown tips; below pale buffy white, with a grayish tone.

The red phase is represented by a single specimen, in which the glandular axillary area is pale yellow. The dark phase is represented by 4 specimens, in one of which an axillar glandular area is not evident, and in a second is less strongly marked than in the other two. All were taken at the same locality and practically on the same date (three on Dec. 17, the other two respectively on Dec. 13 and 15).

Collectors' measurements (3 males, 2 females): Total length, 79 (75–84); head and body, 54 (52–58); tail, 26 (23–29); foot, 11 (10–12); ear, 19 (18–22).

The skull of the type is badly crushed. The measurable skulls give the following: Total length, 3 skulls, 20 (all 20); zygomatic breadth, 2 skulls, 10.2 and 9.6; breadth at base of canines, 4 skulls, 5.4 (5–5.5); breadth at m^3, 6.9 (6.7–7.2).

---

[1] Five new *Rhinolophi* from Africa. Ann. and Mag. Nat. Hist. (7), XIV, pp. 378–388, Nov., 1904.

P^2 is greatly reduced but stands in the toothrow, closely crowded between the canine and p^3.

A peculiar and strongly marked feature of this species is the axillar gland, rendered conspicuous by a short tuft of stiff rust-colored hairs.

22. **Hipposideros caffer centralis** *Andersen.*

Hipposideros caffer centralis Andersen, Ann. and Mag. Nat. Hist. (7), XVII, p. 277, March, 1906. Entebbi, Uganda.

Thirty-nine specimens, of which 22 are skins with skulls and 17 are alcoholic. The sexes are about equally represented; only one specimen is immature (about half-grown). They were collected as follows: Leopoldville, 1, July 10, 1909; Avakubi, 14, Sept. 9–Dec. 2, 1909; Medje, 12, Jan. 20–22, March 11, 23, August 3, 1910; Niangara, 2, Nov. 19, 1910; Faradje, 4, Oct. 22–Nov. 20, 1911; Aba, 3, Dec. 13, 1911; Poko, 3.

Field measurements by the collectors:

Avakubi, 5 specimens: Total length, 93 (86–101); head and body, 58 (55–62); tail, 30.8 (30–39); foot, 10 (10–10); ear, 15.2 (14–16).

Medje, 7 specimens: Total length, 91.7 (88–97); head and body, 57 (53–61); tail, 30 (30–39); foot, 10.4 (10–11); ear, 16.3 (14–18).

Forearm: Avakubi, 6 specimens (from skins), 49.3 (47.2–51.2); 7 specimens (alcoholic), 49.7 (48–51). Medje, 7 specimens (from skins), 52.7 (50.9–54.8).

As shown by the foregoing, the series from Avakubi is slightly smaller in length of forearm than the Medje series, while the collectors' measurements of the Avakubi series average larger. The skull measurements of the two are slightly larger in the Medje series.

Average Measurements of Skulls.

	Avakubi 5 skulls	Medje 9 skulls
Total length	18.3 (17.9–19)	18.8 (18.4–19.8)
Zygomatic breadth	9.7 (9.4–10)	10.3 (9.8–10.6)
Maxillar breadth	6.2 (5.7– 6.6)	6.8 (6.2– 7.2)
Breadth at base of canines	3.9 (3.7– 4.2)	4.4 (4 – 4.6)
Upper toothrow (c–m^3)	6.1 (5.9– 6.5)	6.6 (6.1– 7.4)
Lower jaw (front of incisors to back of condyle)	11.4 (10.9–11.9)	11.8 (11 –12.4)
Lower toothrow (c–m_3)	7.0 (6.4– 7.6)	7.9 (7 – 8.4)

In the Avakubi series only one skull has a total length of 19 mm. and a zygomatic breadth of 10 mm.; in the Medje series 4 skulls exceed 19 mm. (19.1–19.8) in length, and all but two reach or exceed 10 (10–10.6) in zygomatic breadth. The minimum of the Medje series equals the minimum of the Avakubi series, but the maximum of the former is 0.5 to 0.8 mm. greater than the maximum of the latter. There is, however, no appreciable difference in coloration, and the two localities are less than seventy miles apart and in similar environment.

The 3 specimens from Aba agree in size with the Medje specimens. A single specimen from Leopoldville agrees in every way with the Avakubi specimens, but the 3 from Aba, the 4 from Faradje, and the 3 from Poko agree in size with the Medje series, but in some of the Faradje and Poko specimens the pelage is intense orange rufous, both above and below (a little lighter and more intense below than above).

The pelage above in all the skins is brown basally with a lighter intermediate zone and dark rufous tips; below, the base of the pelage is dark brown with long intense reddish orange tips.

All the specimens here referred to *H. caffer centralis* come from well within the range assigned to *centralis* by K. Andersen in his elaborate review of the *H. caffer* group,[1] and also conform satisfactorily to his definition of this form. It is possible, however, that the Leopoldville and Avakubi specimens should be referred to Andersen's *H. caffer angolensis*, and only the more northern examples from Medje, Poko, Faradje and Aba to *H. c. centralis*.

23. **Hipposideros caffer niapu** subsp. nov.

Type, No. 49414 (alcoholic), ♂ ad., Niapu, Belgian Congo, Jan. 27, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2322.

Similar in general coloration to *H. caffer centralis*, but much larger; it has a dark phase and a rufous phase, like the other forms of the *caffer* group.

Type (in rufous phase), upperparts uniform chestnut-brown; underparts cinnamon-brown; ears and membranes dark brown.

In the dark phase the upperparts are hair-brown, below lighter, with the tips of the hairs lighter than the basal fur. Most of the specimens are in the dark phase, which is similar to the corresponding phase of *H. caffer centralis* and *H. abæ*, but none of the specimens in the rufous phase approach nearly to the intensity of coloration seen in many examples of either of these forms.

Measurements: Type, total length, 88; head and body, 58; tail, 30; tibia, 21.8; foot (c. u.), 10.8; ear, 11.2 × 14.5. Forearm, 54.5. In the ten topotypes (including type) the forearm averages 54.7 (53–56).

Skull (type), total length, 20.3; condylobasal length, 17.8; zygomatic breadth, 10.6; mastoid breadth, 10.2; interorbital breadth, 2.9; maxillary breadth, 6.8; breadth at base of canines, 4.8; maxillary toothrow (c–m^3), 66; length of mandible,

---

[1] On *Hipposiderus caffer*, Sund., and its closest Allies; with some Notes on *H. fuliginosus*, Temm. Ann. and Mag. Nat. Hist. (7), XVII, pp. 269–283, March, 1906.

12.4; mandibular toothrow, 7.2. Four male topotype skulls[1] (including type), total length, 20.1 (19.8–20.3); zygomatic breadth, 10.5 (10.3–10.6); interorbital breadth, 2.9 (2.8–3); length of mandible, 12.4 (12.2–12.5).

H. caffer niapu seems clearly to represent a large race of the *caffer* group, larger than any hitherto described. In Andersen's table of measurements of the forms of the *caffer* group,[2] based on 98 specimens (including 75 skulls), the maximum length of the forearm is given as 53.8 for 24 specimens of *centralis,* as against 54.7 in 10 specimens of *niapu,* while the maximum in 40 specimens of typical *caffer* is 51.8. He gives (*l. c.,* p. 276) the average forearm length for 40 specimens of *H. caffer caffer* as 48.6, and for 50 specimens of *centralis-guineensis* (which do not differ in size) as 50.6, as against 54.7 in 10 specimens of *niapu,* the latter exceeding the *centralis-guineensis* series by 4 mm. The skulls bear out the evidence of larger size for the *niapu* series, in which the average total length of the skull is 1 mm. greater than in the *centralis-guineensis* series, which is equal to the average difference between the latter and typical *caffer.*

H. c. niapu is represented by 10 adult specimens (6 males, 4 females), all from the type locality, and all collected the same day. It is clearly specifically different from the much larger *H. abæ* described below from a series of 35 skins and skulls, all from Aba, and all collected also during one day.

24. **Hipposideros abæ** sp. nov.

Type, No. 49123, ♂ ad. (skin and skull), Aba, Uele district, Belgian Congo, Dec. 13, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1715.

Upperparts (type, an average specimen of the dark phase) heavily washed with bistre from the shoulders posteriorly; lighter anteriorly through the shorter dark tips of the hairs, which nearly disappear on sides of head, neck and shoulders, which are thus much lighter than the back; underparts buffy gray, much lighter on throat; ears light brown, rather small, tip obtusely rounded; feet and ventral surface of limbs light brown; membranes dark brown.

Type, total length (collectors' measurements), 104 mm.; head and body, 66; tail, 38; foot, 12; ear (from outer base), 20. Forearm (from skin), 58.5; tarsus, 23.2; foot, 11; ear (from inner base), 16.

Skull (type), total length, 23; zygomatic breadth, 13; width of braincase, 11; maxillar breadth (across m^3), 8.8; breadth at base of canines, 6.1; upper toothrow ($c–m^3$), 8.2; length of mandible, 14; lower toothrow, 9.4.

Posterior border of nose-leaf rounded; three secondary cutaneous leaflets, the outer one slightly developed; a frontal sac in the males, absent or much less developed in females. P^2 uniformly present on both sides in each of the 35 skulls, inserted on the outer border of the toothrow, closely crowded in between the canine and p^3.

---

[1] Selected at random for removal from a series of 10 alcoholic specimens, the series as a whole varying but 3 mm. in the length of the forearm.

[2] Ann. and Mag. Nat. Hist. (7), XII, p. 282, March, 1906.

Represented by 35 specimens (16 males, 19 females, all adult, skins with perfect skulls), all taken at Aba, December 13, 1911.

The collectors' measurements from the fresh specimens (16 males, 19 females), are as follows:

	Total length	Head and body	Tail	Foot	Ear
♂	101.2 (97–107)	65.5 (60–70)	34.2 (32–39)	12 (11–13)	21.4 (20–22)
♀	101.4 (95–105)	65.4 (60–70)	36 (32–40)	12.2 (11–13)	21.5 (20–22)

The forearm and skull measurements (total length and zygomatic breadth) of the same specimens:

	Forearm	Skull
♂	58 (56–60)	23.1 (22.5–23.7) × 13.4 (13.1–13.9)
♀	57.8 (54–60.5)	22.7 (21.9–23.3) × 13.2 (12.6–13.7)

This large series of specimens, all taken the same day at the same locality, and also all fully adult, is especially interesting from the wide range of color variation it presents, which, as shown by the skulls, is wholly independent of age, and probably of sex, although of the 16 specimens in the red phase 11 are females and 5 are males, and none of the males are nearly as red as are the majority of the red phase of the females. The dark phase, on the other hand, includes 11 males, while only 8 females can be assigned to it; and only two of the dark males are strictly referable to the norm of the dark series of females, the others being distinctly intermediate between the dark and red phases.

The *dark phase* may be described as follows: Upperparts, in general effect, washed with drab-brown, lighter on the neck and shoulders, whitish prevailing on the sides of the shoulders; fur at extreme base dusky, with a broad intermediate zone of whitish, the tips of the hairs dark drab-brown, giving a dark brown superficial tone to the dorsal aspect. The extent of the dusky tipping varies greatly in different specimens, and may be almost absent over the shoulders and especially on the sides of the shoulders, giving there a prevailing whitish tone. In general the white middle zone of the fur shows more or less at the surface. Underparts uniform dingy pale buff with a faint superficial wash of yellowish. Basal portion of the fur very pale brown, showing more or less through the pale buffy tips.

Red phase. Upperparts cinnamon-brown, often darkening on the middle of the back to nearly chestnut-brown. Fur at extreme base slightly darkened, the broad middle zone pale cinnamon, the tips of the hairs dark ruddy brown; sides of shoulders light yellowish white. The underparts vary in different specimens from pale buffy to deep reddish ochraceous; in average female specimens, pale ochraceous. This is the 'red' phase as shown in females; the males in the red phase are much less rufous, both above and below, the upperparts being of a much darker and less reddish tone, and the ventral surface is seldom brighter (yellowish buff).

Many of the males and some of the females are so nearly intermediate between the two phases that it is difficult to assign them satisfactorily to either. None of the specimens is young enough to indicate the character of the immature or juvenile pelage.

Hipposideros abæ is allied to the *H. caffer* group, from which it differs in considerably larger size, and lighter and more buffy underparts. *H. caffer centralis* occurs with *H. abæ* at the type locality of the latter. Average length of forearm in *H. abæ* (35 specimens), 58 mm.; of *H. caffer centralis,* 50; total length, *H. abæ,* 101, *H. c. centralis,* 92. Skull, *H. abæ,* 23 × 13.3; of *H. c. centralis,* 18.5 × 10.

25. **Hipposideros nanus** sp. nov.

Type, No. 49426 (alcoholic), ♀ ad., Faradje, Uele district, Belgian Congo, Oct. 24, 1912; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1689.

A very small species of the *H. beatus* type.

Upperparts dusky brown, the hairs dark at base and tips with a broad median zone of white; underparts lighter, the hairs with grayish tips; ears and membranes dark brown.

Total length, 68 mm.; head and body, 46; tail, 22; forearm, 43.4; third metacarpal, 31; tibia, 16.5; foot, with claws, 7.9; ear, length, 9.2, width, 12; greatest breadth of horseshoe, 5; of posterior leaf, 5.5.

Skull, total length, 16.2 (16.8)[1]; zygomatic breadth, 8.2 (9.7); mastoid breadth, 8.5 (9.2); maxillary breadth, 5.5 (7), breadth at base of canines, 4.5 (4.3–4.7); mandible, 9.5 (10.7–11.3); upper toothrow (c–m^3), 5.2 (5.9–6.2); lower toothrow, 5.7 (6.2–7).

Represented by only the type.

Hipposideros nanus is nearly related to *H. beatus* Andersen (*l. c.,* p. 279), from near Benito River, Guinea, and may be considered as its geographical representative in the Uele district of northeastern Belgian Congo.

26. **Hipposideros langi** sp. nov.

Text Figs. 4–6.

Type, No. 49098 (skin and skull), ♂ ad., Avakubi, Jan. 24, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2481.

A large species, with long, soft, woolly pelage, allied in general features to *Phyllorhina cyclops* Temminck.

---

[1] The measurements in parentheses are the corresponding measurements of 2 skulls of *H. beatus* as given by Andersen, Ann. and Mag. Nat. Hist. (7), XVII, p. 281, March, 1906.

Upperparts, in general effect, blackish grizzled with white, the pelage being brownish black at base and apically with a narrow subapical zone of white; head grayish brown, much lighter than the back, with dusky eyerings; underparts uniform dusky brown, the tips of the hairs lighter, giving a decidedly grayish general effect, considerably lighter than the back. Proximal half of forearm heavily furred. Ears and membranes naked, blackish brown, the wing and leg bones and the feet much lighter than the membranes, especially on the ventral aspect.

Ears narrow and attenuate, tapering apically to a sharp point. Interfemoral membrane deeply hollowed; tail very short, about one-third of the length of head and body, the terminal vertebra free. Thumb short. A large frontal sac in both sexes, lined with silky straight hairs, wholly white, or white at base with light brownish tips. When the sac is everted these white hairs form a conspicuous white tuft. A glandular pouch is present in males just in front of the anus, lined with long, rusty brown bristly hairs, which when the pouch is everted form a conspicuous tuft, the hairs being more or less obvious even when the pouch is not everted. The females appear to lack the anal pouch, but have in its place a pair of elongated nipple-like papillæ, usually clubshaped or thickened apically. These are conspicuous in alcoholic specimens and usually readily observed in dry skins. They are situated about 5 mm. apart and have a length of about 8 mm.

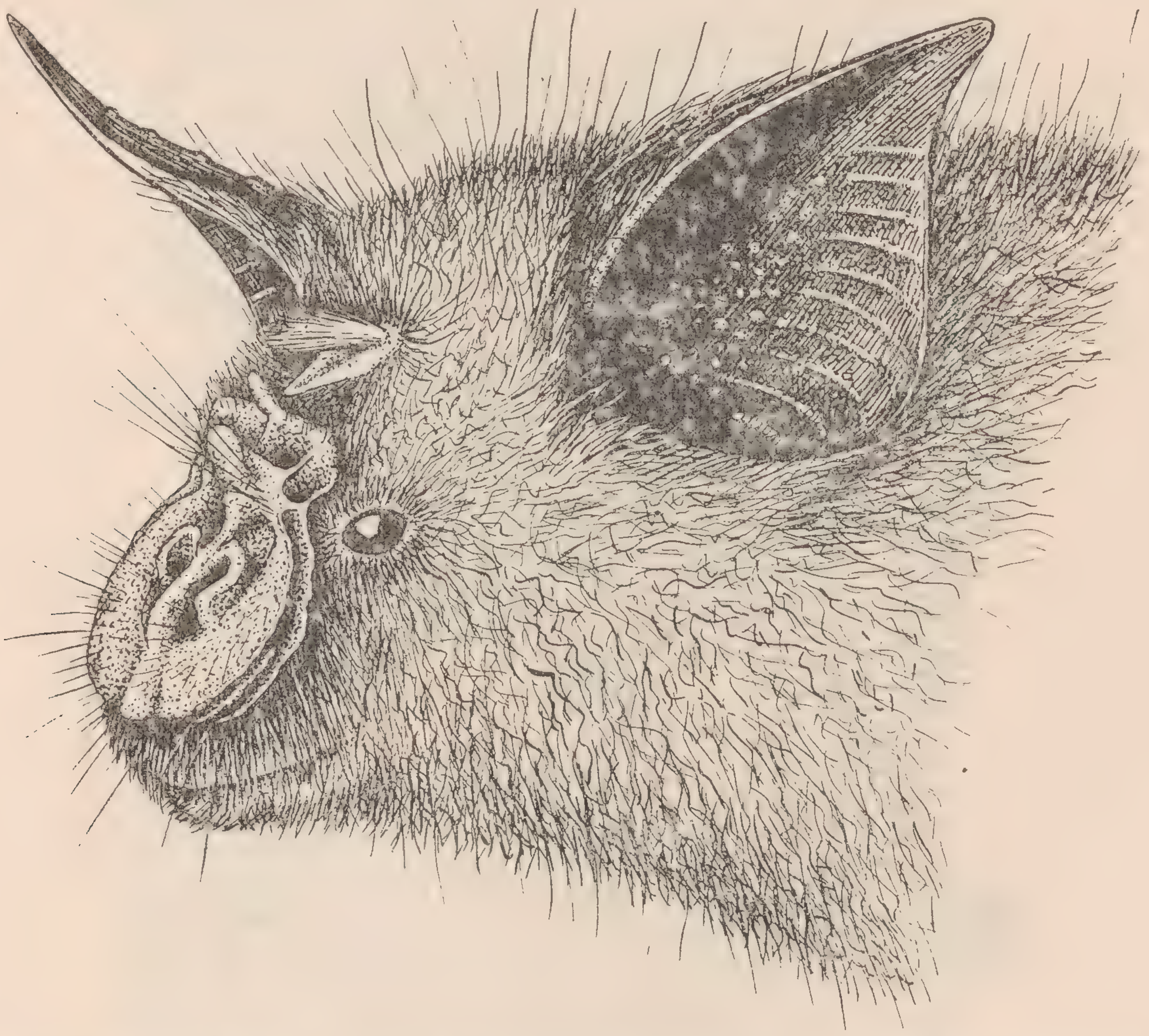


Fig. 4. ***Hipposideros langi.*** **Head of adult male (No. 49391), showing nose-leaves and frontal sac.** $\frac{2}{1}$.

Nose-leaf very broad (about 20 mm. wide); posterior leaflet narrow (about 10 mm. wide), with a narrow central point 2 mm. high and 0.5 mm. wide. The nostrils are enclosed posteriorly and laterally by a fleshy conch-shaped border. There is a prominent fleshy knob at the posterior border of the nose-leaf, and two supplemental leaflets, the inner strongly and the outer weakly developed.

Type, total length (collectors' measurements), 114 mm.; head and body, 87; tail, 27; foot, 20; ear, 33. Collectors' measurements of 4 adults (3 females and the male type), total length, 113 (110–116); head and body, 85.5 (83–87); tail, 28 (27–30); foot, 19.5 (19–20); ear, 33.8 (33–35).

Forearm in 10 specimens (6 skins and 4 alcoholics), 68 (66.2–68.8).

Type skull, total length, 28.1; condylobasal length, 25.1; zygomatic breadth, 14.9; mastoid breadth, 12; interorbital breadth, 2.8; breadth at base of canines, 8.4; maxillar breadth, 10.7; maxillary toothrow (c–m^3), 10.1; length of mandible, 18.6; mandibular toothrow (c–m_3), 10.9.

Six adult skulls (5 females and the male type), total length, 28.4 (28–29); condylobasal length, 25.2 (24.5–25.7); zygomatic breadth, 15.4 (14.9–15.9); mastoid breadth, 12.1 (11.8–12.4); interorbital breadth, 2.9 (2.8–3.1); breadth at base of canines, 7.8 (7.2–8.4); breadth of rostrum (at point of greatest inflation), 8.2 (8–8.5); maxillar breadth, 11 (10.7–11.3); maxillary toothrow (including canine), 10.1 (9.8–10.4); length of mandible, 19 (18.4–19.4); mandibular toothrow (including canine), 11 (10.9–11.2).

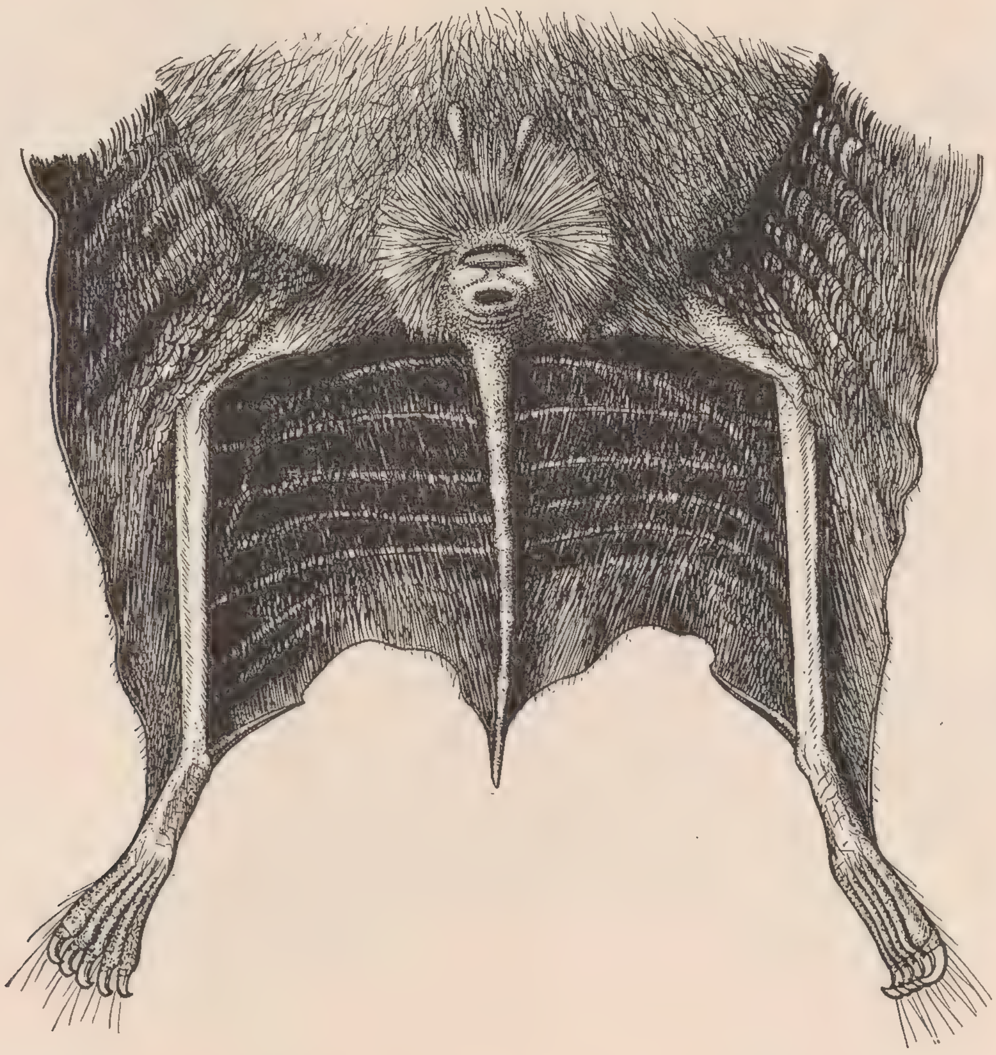


Fig. 5. *Hipposideros langi.* Pubic region of female (No. 49389). $\frac{1}{1}$.

P^2 is minute, and stands outside of the toothrow, the cingula of the canine and p^3 being in close contact.

Posterior border of palate broadly U-shaped, with a slight median point, and extends to a line passing through the posterior border of m^2.

Represented by 14 specimens, of which 5 are alcoholic, collected as follows: Avakubi, 4, of which 3 were taken Jan. 24–26, 1914, and 1 in October, 1913; Niangara, 2, Dec. 3 and 6, 1910; Medje, 7, April 27 and Sept. 3, 1910; Niapu, 1, Oct. 28, 1914. Two of the Medje specimens are half-grown young, and two others are young adults, not fully mature as regards size. The others are fully adult, all with perfect skulls except the Niapu specimen, of which the skull is too much broken for measurement.

The specimens represent two seasonal periods, April, and September–January. The April specimens (from Medje), in worn pelage, are browner and the light tips of the hairs are stained faintly yellowish in contrast with the clear blackish brown ground-color and whitish hair-tips of the Septem-

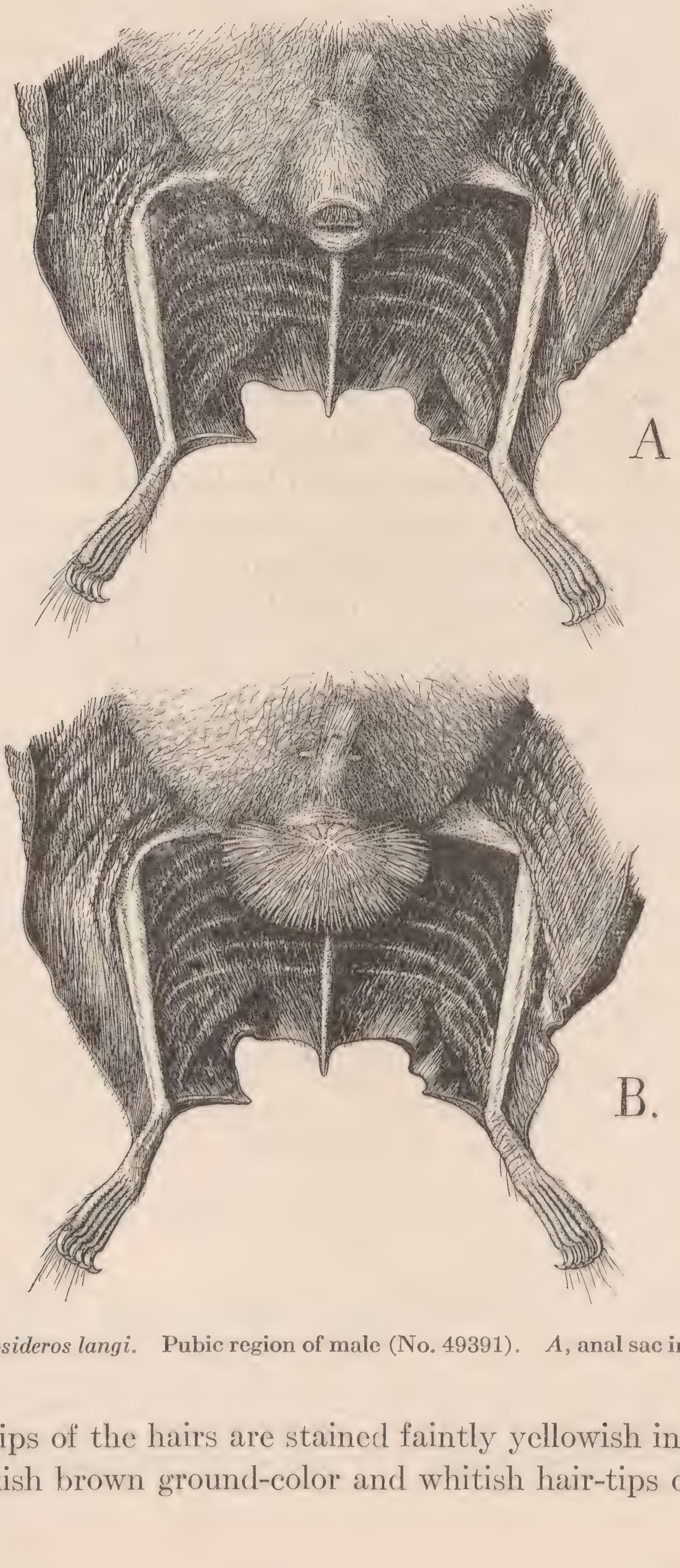


Fig. 6. *Hipposideros langi.* Pubic region of male (No. 49391). *A*, anal sac invaginated; *B*, anal sac everted. $\frac{1}{1}$.

ber–October and January specimens. That the difference is probably purely seasonal is indicated by a Medje specimen taken in September, which is dark with white hair-tips, like the October–January specimens from other localities.

In its soft woolly pelage and other external features *Hipposideros langi* appears to resemble closely *Phyllorhina cyclops* Temminck, from the Boutry River, Guinea, but it is a much larger species and darker in coloration, being blackish brown with white hair-tips instead of dull brown with yellowish hair-tips. *H. cyclops*, however, appears to be little known, the only original references to it being Temminck's description [1] and Dobson's account,[2] based on two specimens, including one from the Cameroon Mountains, the other without definite locality. Neither of these descriptions is very satisfactory, the character of the skull not being mentioned in either. Dobson's measurements indicate a total length of about 93 mm., and Temminck's a total length of about 89 mm., as against an average of 113 mm. for 4 specimens of *H. langi*. Dobson gives the length of the forearm as 62.2, as against an average of 68 in 10 specimens of *H. langi*. Temminck gives the length of the forearm as 38 mm. ("antibrachium 1 pouce 7 lignes"), which is obviously an error (possibly a misprint for 2 pouces 6 lignes = 63 mm.).[3] The type localities of the two forms are widely separated. Dollman, however, has recorded two specimens from Avakubi (Rev. Zool. Africaine, IV, fasc., 1, 1914, p. 76), as "*Hipposideros cyclops*, Temm.," which probably are referable to the present form.

H. langi differs greatly from all the African species of the genus *Hipposideros* except *cyclops*, from which it is distinguishable by much larger size and darker coloration.

27. **Hipposideros gigas niangaræ** subsp. nov.

Plate LI, Fig. 1.

Type (and only specimen), No. 49103, ♀ ad., skin and skull, Niangara, Uele district, Belgian Congo, June 2, 1913; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2069.

A small member of the *H. gigas* group. Dorsal hair-brown Y-patch of short dense fur well defined; upperparts anterior to the Y-patch with the fur much longer and looser and of a pale brownish gray, the extreme tips of the hairs, particularly on the posterior third of this area, whitish; still paler on the top and front of the head; sides of the head lighter than the top, and joined by a narrow still lighter band enclosing the nose-leaf area; sides of back grayish posteriorly, like the anterior back, separated from the Y-patch by a whitish transverse band about 13 by 6 mm. in extent; a patch of clear white on the sides beneath the junction of the propatagium with the body and extending slightly in front of it, bounded ventrally by a band of dark hair-brown fur, a lateral extension of the dorsal Y-patch; general color of underparts yellowish gray, with a broad median band of dusky gray, the fur darker basally; ears, feet and membranes blackish. Ears long and tapering, the extreme tip slightly rounded. Membranes attached about 5 mm. above tarsal joint. Supplementary leaflets three, well-defined.

---

[1] Esquisse zoologique sur la Côte de Guiné, 1853, pp. 75–77.

[2] Cat. Chiropt. Brit. Mus., 1878, p. 76.

[3] Dobson's principal measurements of a male in alcohol, from the Cameroon Mountains are: "Length (of an adult ♂), head and body 2″ .8 [71.12 mm.], tail 0″ .85 [22], ear 1″ .15 [38], nose-leaf 0″ .5 × 0″ .5 [12.7 × 12.7], forearm 2″ .45 [62.23], tibia 1″ .15 [29.2], foot 0″ .65 [16.5].

Temminck's measurements are: "Longueur du bout du museau à la pointe de la queue 3 pouces 6 lignes [about 89]; hauteur des oreilles 1 pouce [25.4]; queue 6 lignes [12.7]; envergure 12 pouces 6 a 9 lignes [about 273]; antibrachium 1 pouce 6 lignes [38], probably in error].

Collectors' measurements: Total length, 137 mm.; head and body, 107; tail, 30; foot, 25; ear (from outer base), 35.

Forearm (in skin), 104; third metacarpal, 72; tail, 30; lower leg, 40.5; breadth of nose-leaf, 11.7.

Skull, total length, 35.3 (39.8 [1]); zygomatic breadth, 20 (22.2); mastoid breadth, 15.8 (18.2); maxillary breadth, 14 (14.2); antorbital breadth, 11 (11); across cingula of canines, 10.5 (11.6); mandible, 24.4 (27.8); upper teeth, 13.5 (13.8–14.5); lower teeth, 15.5 (16–16.3).

The single specimen of *H. niangaræ* is a fully adult female, with a strongly developed sagittal crest, but the teeth are not appreciably worn. It has the coloration and general characters of *H. gigas*, from which it differs in much smaller size, the forearm measuring only 104 mm. as against 108–116 mm. given by Andersen (*l. c.*, p. 48) for 6 specimens of *H. gigas* [2]; while the total length of the skull is 35.3 as against 39.8 given by Andersen for *gigas*, with other skull measurements proportionally less.

The type locality of *H. gigas* is the Benito River in Angola, and the 8 specimens cited by Andersen are likewise all from Angola. The type, and apparently the only recorded specimen, of *H. gigas gambiensis* is from Gambia, in the same general region. On the other hand the type of *niangaræ* is from the Uele district of the Belgian Congo, a region of quite different physical conditions and more than a thousand miles westward.

VESPERTILIONIDÆ.

28. **Myotis bocagii bocagii** (*Peters*).

Vespertilio bocagii PETERS, Jorn. Sci. Math.-Phys. e Nat. Lisboa, 1870, No. 10, p. 125, Dec. 1870. Portuguese West Africa.

---

[1] The measurements in parenthesis are those given by K. Andersen for *H. gigas* (Ann. and Mag. Nat. Hist. (7), XVII, 1906, p. 48).

[2] The average of 4 skulls given by Andersen (*l. c.*, p. 40, last footnote) is 110.25.

A single specimen, a nearly adult male, collected at Leopoldville, July 8, 1909, is provisionally referred to typical *bocagii*. It agrees in the coloration of the upperparts with *M. b. cupreolus*, but in the coloration of the underparts differs from all the other 24 specimens of the *bocagii* group collected by the Expedition, being ashy gray without any buffy tinge instead of pale buff to ochraceous buff, as in both *cupreolus* and *hildegardeæ*. That the difference is not due to immaturity is shown by perfectly comparable specimens from other localities.

29. **Myotis bocagii cupreolus** *Thomas.*

Myotis bocagei cupreolus Thomas, Ann. and Mag. Nat. Hist. (7), XIII, p. 407, 1904. Efulen, Bulu Country, Cameroons.

Fourteen specimens (12 skins with skulls and 2 in alcohol), collected as follows: Bafwabaka, 11, Jan. 4–7, 1910; Medje, 3 (1 ad., 2 juv.), June 27, 1909.

Collectors' measurements of the Bafwabaka series (4 ad. males, 4 ad. females): Total length, 86.6 (83–90); head and body, 47 (46–50); tail, 39.6 (36–42); foot, 12 (all 12); ear, 15 (all 15).

Forearm of same specimens (in skin), 38 (37.3–38.8). Skulls of same specimens, 14.6 (14.1–15.1).

It may be worth while to note that the length of the red tips to the hairs of the back varies from 2 to 5 mm. in specimens taken at Bafwabaka on the same day, as this feature has sometimes been considered of value as a diagnostic character.

30. **Myotis bocagii hildegardeæ** *Thomas.*

Myotis hildegardeæ Thomas, Ann. and Mag. Nat. Hist. (7), XIII, p. 209, March, 1904. Fort Hall, Kenya District, British East Africa. Alt. 4000 feet.

Thirteen specimens (skins, 7 with skulls), collected as follows: Aba, 11, Dec. 16–19, 1911; Faradje, 2 (1 in alcohol), March 25, 1911.

Collectors' measurements (10 specimens from Aba (6 males, 4 females): Total length, 90 (85–96); head and body, 50 (40–53); tail, 40 (38–42); foot, 11.2 (10–12); ear, 14.4 (13–16).

Forearm (same specimens), 38.6 (36.7–40.5). Skull (5 Aba specimens), total length, 14.9 (14.6–15.5).

The series of specimens from Aba averages slightly larger in all measurements than the series from Bafwabaka, referred above to *M. bocagii cupreolus*, and the coloration is much paler.

31. **Pipistrellus nanus** (*Peters*).

Vespertilio nanus Peters, Reise nach Mossambique, I, Säugeth., p. 63, pl. xvi, fig. 2. Inhambani, Mozambique, S. lat. 24°.

Sixty-seven specimens (of which 39 are alcoholic): Stanleyville, 6 (2 alcoholic), Aug. 5–27, 1909; Risimu, 1 (alcoholic), Sept. 9, 1909; Ngayu, 4 (1 alcoholic), Dec. 14, 1909; Bafwabaka, 30 (9 alcoholic), Jan. 5–14, 1910; Gamangui, 1, Feb. 27, 1910; Medje, 6 (5 alcoholic), Oct. 7, 1910; Niangara, 9 (1 alcoholic), Nov. 11–14, 1910; Faradje, 7 (4 alcoholic), Feb. 18, 1912; Yakuluku, 1 (alcoholic), Nov. 4, 1912; Poko, 1 (alcoholic), Aug. 30, 1913; Garamba, 1, March 15, 1912.

Collectors' measurements of the Bafwabaka series (10 males and 10 females, all adult):

	Total length	Head and body	Tail	Foot	Ear
♂	74.6 (72–78)	42.6 (37–47)	32.8 (31–37)	7.0 (7–7)	11.7 (11–12)
♀	74.6 (68–79)	42.7 (37–47)	32.7 (30–37)	6.7 (6–7)	11.9 (11–12)

Forearm (from skin, same specimens) ♂ 31 (29.8–32); ♀ 31.6 (30.7–32); forearm, 6 alcoholics (3 males, 3 females) from same locality, 30.8 (29–31.5).

Collectors' measurements of the Niangara series (3 males and 6 females): Total length, 76 (74–77); head and body, 41 (38–43); tail, 35 (33–37); foot, 6.9 (6–7); ear, 10.1 (10–11). Forearm (same specimens), 30.9 (30–31.9).

The Bafwabaka and Niangara specimens are indistinguishable, either in size or coloration, and the specimens from the other localities are not distinguishable from those from Bafwabaka and Niangara.

The range of color variation in fully adult individuals is slight, the dark brown tone of the upperparts, which has a faint reddish cast, is slightly lighter in some than in others, and the same is true of the dull, pale buffy brown of the ventral surface. Immature specimens are much darker — blackish brown, in some cases nearly black.

In studying the above recorded material I have had for comparison with it seven skins and skulls (also additional skulls) from the Yala River, British East Africa, collected by H. J. A. Turner, and one specimen from Ruwenzori East, collected by R. B. Woosnam, all identified as *Pipistrellus nanus*.[1] These specimens are essentially the same in size and coloration as my specimens from the Congo Basin. They average slightly darker but even the darkest examples can be matched by numerous specimens from the Congo region. The length of the forearm in the eight specimens from British East Africa averages 31.7 mm. (30.3–32.3) as against 30.8 (29–31.5) in 20 specimens from Bafwabaka, and 30.9 (30–31.9) in nine specimens from Niangara, and 30 (29–31) in three adults from Stanleyville. The corresponding measurement in the type and two topotypes of *Pipistrellus aero* Heller is 31.3 (30.5–31.5), which specimens to me appear indistinguishable from the British East Africa specimens labeled *P. nanus*.[1]

---

[1] Borrowed from the United States National Museum.

32. **Pipistrellus abaensis** sp. nov.

Type, No. 48979, ♀ ad. (skin and skull), Aba, Belgian Congo, Dec. 18, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1825.

Size of *P. nanus*, but much lighter in coloration, and with the sides of lower back broadly naked.

Upperparts light brown or pale isabella-color, the hairs nearly unicolor from base to tip; underparts pale buffy gray, the basal portion of the hairs nearly black, the tips light grayish with a slight buffy tone. Wing membranes attached to the entire length of the basal joint of the outer toe. Ear small, pointed, about equally convex on both borders.

Type, total length (collectors' measurements), 77 mm.; head and body, 44; tail, 33; foot 7; ear, 10. Additional measurements from skin: Forearm, 31.4; third metacarpal, 29.7; tibia, 12.4; foot, 6; ear 7.2. An adult female topotype is larger: Total length (collectors' measurements), 84; head and body, 53; tail, 31; foot, 8; ear, 12. Forearm (in skin), 32.1; third metacarpal, 30; tibia, 12.8; foot, 6.8; ear, 9. (The skull of this specimen, No. 48980, is lost.)

Skull (type), total length, 11.7; breadth of braincase, 6.2; interorbital breadth, 3.1; maxillar breadth, 4.6; upper toothrow, 4; length of mandible, 8.1; lower toothrow, 4.2. Incisors subequal in size, the inner one slightly bifid. P^2 exceedingly minute, inserted on extreme inner edge of toothrow.

Represented by 3 specimens, the type and two topotypes; both of the latter lack skulls. Only two of the specimens, both females, are adult, one slightly larger than the other, but both indistinguishable in coloration. The third specimen is an immature male with the epiphyses not ankylosed but nearly adult in respect to size. It differs from the others in the pelage being nearly black above but somewhat lighter and more brownish below. All three of the specimens agree in having the sides of the lower back naked, the bare space being 5 to 6 mm. wide and 17 to 20 mm. long, extending from the base of the tail membrane anteriorly for more than half the length of the body. This feature, combined with small size, pale coloration and subequal upper incisors should render the present form easily recognizable. As said above, it is about the size of *P. nanus*, from which it differs strikingly in coloration, in the shape of the ears, and in the character of the upper incisors and upper premolars. It does not appear closely related to any described species.

---

[1] Received at the U. S. National Museum *after* the publication of Mr. Heller's description of *Pipistrellus aero*.

33. **Pipistrellus musciculus** *Thomas.*

Pipistrellus musciculus Thomas, Ann. and Mag. Nat. Hist. (8), XI, p. 316, March, 1913. Bitye, Ja River, S. E. Camaroons. Alt. 2000 feet.

One specimen, adult female, in alcohol, Avakubi, Feb. 26, 1914. Forearm, 25.2; skull, total length, 11; zygomatic breadth, 7.7.

34. **Scotozous rüppelii** (*Fischer*).

V[espertilio] rüppelii Fischer, Synop. Mamm., 1829, p. 109. Dongola.

One specimen, adult male in alcohol, Poko, August, 1912.

Forearm, 31.3. Skull, total length, 13.1; condylobasal length, 12.5; zygomatic breadth, 9.3; breadth of braincase, 7.2; upper toothrow ($c-m^3$) 4.5; length of mandible, 8.6; lower toothrow ($c-m_3$), 5.1.

35. **Eptesicus tenuipinnis** (*Peters*).

Vesperus tenuipinnis Peters, Monatsb. Akad. Berlin, 1872, p. 263. Guinea.—Noack, Zool. Jahrb., IV, 1889, p. 218. Kuilu-Fluss, Lower Congo district.

Seven specimens (4 skins and skulls, 3 alcoholic), Ngayu, near Avakubi, December, 1909.

Collectors' measurements (1 male, 3 females): Total length, 71 (68–73); head and body, 42 (40–44); tail, 29.5 (28–31); foot, 8 (8–8); ear, 11.5 (11–12).

Forearm (from skins), same specimens, 28.8 (27.9–29.4); two adults in alcohol, male 27.5, female 28. Skulls (four specimens), total length, 12.2 (11.9–12.9); breadth of braincase, 6.2 (6–6.3).

In this series the ears are white; the hairtips on the upperparts are slightly silvery yellowish in two specimens, nearly absent in the other two. Membranes pale yellow in dry skins, pure white in alcoholic specimens.

36. **Eptesicus ater** sp. nov.

Type, No. 48988, ♂ ad., skin and skull, Faradje, March 1, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1466.

Similar in general appearance to *E. tenuipinnis* but smaller, with black ears and feet, and wholly black above.

Pelage of upperparts brownish black to base of hairs, which are without light tips; below the hairs of foreneck and upper chest brownish black tipped with whitish, rest of lower parts clear white, the hairs dusky at base; wing membranes white above and below; interfemoral membrane brownish white above, paler below; ears, feet, tail and limb bones dark brown, in strong contrast with the light-colored membranes. Size and general structure, including ears and tragus, as in *E. tenuipinnis*.

Collectors' measurements of type: Total length, 68 mm.; head and body, 39; tail, 29; foot, 6; ear, 12. Forearm (from skin), 27.5; in an adult male topotype, 27.9; in two subadult specimens from Niangara, ♂ 27, ♀ 25.

Skull, type, total length, 12.2; condylobasal length, 11.6; zygomatic breadth, 7.5; breadth of braincase, 6.6; interorbital breadth, 3.4; maxillar breadth, 5.2; breadth at base of canines, 4; length of upper toothrow (c–m^3), 4; length of mandible, 8.4; angle to condyle, 1.5; depth at coronoid, 2.5.

Represented by 4 specimens: Faradje, 2 (type skin and skull and alcoholic topotype); Niangara, 2 (subadult skins with skulls).

E. ater is nearly related to *E. tenuipinnis*, from which it differs in the much darker coloration of the pelage, the ears and feet blackish instead of pale yellow, and in slightly smaller size.

37. **Eptesicus faradjius** sp. nov.

Type, No. 49045, ♀ ad., skin and skull, Faradje, northeastern Belgian Congo Feb. 21, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1914.

Upperparts tawny olive, the hairs dusky at extreme base; underparts similar but much paler, the tips of the hairs light tawny on throat, breast and middle of belly, more fulvous on side and pubic region; ears pale brown; limb bones and interfemoral membrane light brown above, paler below; wing membranes pale yellow on both surfaces.

Collectors' measurements of type: Total length, 93; head and body, 59; tail, 39; foot, 8; ear, 11. Forearm (from skin), 33.

Collectors' measurements of ten topotypes (5 males, 5 females): Total length, ♂ 88 (83–95), ♀ 92.6 (90–96); head and body, ♂ 51 (46–56), ♀ 54.2 (52–56); tail, 37 (35–38), ♀ 39 (35–43); foot, 8.4 (8–9), ♀ 8.4 (8–9); ear, ♂ 11.4 (11–12), ♀ 11.4 (11–12). Forearm (same specimens), ♂ 33.5 (32.5–35.6), ♀ 34.9 (32.5–36.2).

Skull (type), total length, 13.8; condylobasal length, 13; zygomatic breadth, 8.8; breadth of braincase, 7; mastoid breadth, 8.2; interorbital breadth, 4; maxillar breadth, 6.1; breadth at base of canines, 4.9; upper toothrow (c–m^3), 4.6; length of mandible, 10.2; angle to condyles, 1.8; depth at coronoid, 3.2; lower toothrow, 5.3. Skull, 9 topotypes (4 males, 5 females): Total length, ♂ 13.5 (13.2–13.9), ♀ 13.7 (13.4–13.7).

Represented by 24 specimens: 14 (topotypes) from Faradje, collected February 18–21, March 1–30, and August 2, 1911, and 10 from Niangara, collected November 16–December 26, 1910.

The two series are indistinguishable in every respect. Each series, however, shows a considerable range of variation in color, some of it due to age but mainly purely individual, the fawn color of the upper parts varying greatly in tone in different specimens, independently of sex and age.

There is apparently a slight sexual difference in size, the females having the forearm averaging about 2 mm. longer than the males, and there is a corresponding but slighter average difference in the length of the skull.

Eptesicus faradjius appears to be related to *E. flavescens* (Seabra), but it is smaller than the latter and should be readily distinguishable from it by the deep fawn color of the upperparts (varying in different specimens from light yellowish to olivaceous and even to slightly rufescent in different specimens), combined with a forearm length of about 34 mm. as against 37 in *flavescens*.[1] It is very different in coloration from *E. phasma*, with a large series of which it has been compared, and with which it closely agrees in size.

38. **Eptesicus minutus minutus** (*Temminck*).

Vespertilio minuta Temminck, Mon. Mammal., II, 1835–41, p. 209. "Elle vit.... dans plusieurs parties de la pointe méridionale de l'Afrique."

Two specimens in alcohol, both adult males, appear referable to this species: Niangara, 1, March 27, 1913; Isiro, 1, July 3, 1913.

Forearm, Isiro specimen, 28.5; Niangara specimen, 28.2. Skull, Isiro specimen, total length, 12; zygomatic breadth, 8.5; mastoid breadth, 7.3; upper toothrow (c–m^3), 4. The skull of the Niangara specimen is too fragmentary for measurement.

39. **Eptesicus garambæ** sp. nov.

Type (and only specimen), No. 49340, ♂ ad. in alcohol, Garamba, March 14, 1912; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1888.

Upperparts very dark brown, the hairs without appreciably lighter tips; underparts similar but slightly paler, the tips of the hairs faintly grayish; membranes naked, blackish with a very narrow whitish edging; inner surface lighter and slightly grayish; lower surface of limb bones whitish, in strong contrast with the dark membranes; wing membranes from base of outer toe; last caudal vertebra free for half its length; proximal vertebræ slightly hairy.

---

[1] The external measurements of 13 specimens of *flavescens*, as given by Seabra are: Total length, 117 (111–126), in 10 specimens of *faradjius*, 90 (83–96); head and body (*flavescens*), 85 (81–90), in *faradjius*, 52.6 (46–56); tail in *flavescens*, 33 (30–36), in *faradjius* 36 (35–43). *Cf.* Seabra, Jorn. Sc. Math.-Phys. e Nat. Lisboa (2), VI, p. 125, Feb. 1900.

Total length, 77.6 mm.; head and body, 44.6; tail, 33; forearm, 33; third metacarpal, 31.3; tibia, 12.6; foot, 9.1; ear from crown, 7.7; from notch, 12; length of tragus, 5.8.

Skull, total length, 13.7; condylobasal length, 13.1; zygomatic breadth, (?); mastoid breadth, 7.6; interorbital breadth, 4.7; breadth of braincase, 6.7; maxillar breadth, 5.4; breadth at canines, 4; upper toothrow (c–m^3), 4.5; length of mandible, 9.4; angle to condyle, 1.7; depth at coronoid, 3.4; lower toothrow, 4.8.

Eptesicus garambæ, in size and external characters, resembles *E. ugandæ* Hollister, from Ledgus, Uganda, but exceeds it considerably in size, and differs from it in the form of the tragus and other characters, the last caudal vertebræ extending half its length beyond the membrane instead of wholly enclosed within it as in *ugandæ.* The skull proves, on comparison with topotype skulls of *ugandæ,* to not only exceed it greatly in size, but is much broader and flatter, and the rostral portion much broader, the skull as a whole much more massive and depressed.

40. **Mimetillus moloneyi** (*Thomas*).

Text Fig. 22 *A* (p. 537).

Vesperugo (*Vesperus*) *moloneyi* THOMAS, Ann. and Mag. Nat. Hist. (6), VII, p. 528, June, 1891. Lagos, West Africa.

Four specimens, all adult males (2 skins with skulls, an extra skull and a specimen in alcohol), collected as follows: Stanleyville, 1 (skin and skull), Aug. 25, 1909; Medje, 2 (skin and 2 skulls), June 26, 1910; Avakubi, 1 (alcoholic), Dec. 19, 1913.

Collectors' measurements of the two skins: Total length, 84, 85 mm.; head and body, 58, 58; tail, 26, 27; foot, 6, 8; ear, 13, 15.

Forearm (from skin), 27, 28.7; third metacarpal, 29, 30.6; third finger, 42.8, 44; fifth finger, 29, 30.6. Avakubi specimen (alcoholic), forearm, 28.2; third metacarpal, 28.8; third finger, 42.4; fifth finger, 30.4; foot, 6; ear from crown, 7.4, from notch, 11. (Skull badly broken.)

Three skulls, total length, 14.1 (13.8–14.3); condylobasal length, 13.7 (13.6–13.8); zygomatic breadth, 10.3 (10.2–10.3); breadth of braincase, 8.2 (8.1–8.2); upper toothrow, 4.6 (4.5–4.8).

The remarkable reduction in the size of the wings of this species, as mentioned by Thomas in his original description (*l. c.*), and later made by him the basis of the genus *Mimetillus* (Proc. Zool. Soc. London, 1862, II, p. 188), is graphically shown by Chapin in Plate LV, and is the subject of special comment in Part III, pp. 535–536, of this paper.

41. **Scoteinus schlieffenii** (*Peters*).

Nycticejus schlieffenii Peters, Monatsb. Akad. Berlin, 1859, p. 224. Cairo, Egypt.

Scoteinus schlieffenii G. M. Allen, Bull. Mus. Comp. Zoöl., LVIII, No. 7, p. 349, July, 1914. Bados, Blue Nile.

One specimen, adult male (in alcohol), Niangara, June 20, 1913.

Forearm, 32.8 mm. Skull, total length, 14; condylobasal length, 13.6; zygomatic breadth, —; breadth of braincase, 7.1; upper toothrow (c–m^3), 5.1.

42. **Pachyotus altilis** (*G. M. Allen*).

Scotophilus altilis G. M. Allen, Bull. Mus. Comp. Zoöl., LVIII, No. 7, p. 350, July, 1914. Aradeiba, above Roseires, Blue Nile, Sudan.

Two specimens, an adult female (skin and skull) and an adult male (in alcohol), Faradje, March 7, 1912.

Collectors' measurements of female: Total length, 118; head and body, 70; tail, 48; foot, 10; ear, 15. Forearm, 46.8. On the collectors' label of this specimen is written: "2 large embryos in uterus." Alcoholic, male, forearm, 46.2.

Compared with a paratype of the species from Bados, Blue Nile.

43. **Pachyotus nigrita nux** (*Thomas*).

Scotophilus nigrita nux Thomas, Ann. and Mag. Nat. Hist. (7), XIII, p. 208, March, 1904. Efulen, Camaroons.

Two specimens in alcohol, adult females, Medje, March, 1914.

Forearm, 55.6, 56.4 mm. Skull, total length, 21.6, 22.1; zygomatic breadth, 14.6, 14.9; upper toothrow (c–m^3), 7.2, 7.6; length of mandible, 14.4, 15; lower toothrow, 8.2, 8.4.

44. **Glauconycteris papilio** *Thomas*.

Glauconycteris papilio Thomas, Ann. and Mag. Nat. Hist. (7), XV, p. 77, Jan., 1905. Entebbe, Uganda.

Twenty specimens (17 skins with skulls, 3 alcoholic), collected as follows: Niangara 4 (2 alcoholic), Nov. 14–16, 1910; Faradje, 13, March 14–16, 1911; Aba, 3 (1 alcoholic), Dec. 13, 1911.

Collectors' measurements of the Faradje series, 11 adults (4 males, 7 females): Total length, 103 (100–108); head and body, 54 (52–57); tail, 50 (44–53); foot, 9.4 (9–10); ear, 12.5 (11–13).

Forearm (in skin), same specimens, 42.6 (41–44.7). Skull, same specimens, total length, 13.4 (12.8–13.9); breadth of braincase, 7.8 (7.4–8.1).

Three subadult specimens have the underparts pure white instead of yellowish white as in adults, and the upperparts are wood brown instead of yellowish rufous.

45. **Glauconycteris humeralis** sp. nov.

Text Fig. 7, *A*.

Type, No. 49013, ♀ ad. (skin and skull), Medje, Belgian Congo, Sept. 7, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 956.

Size medium. A conspicuous tuft of white hairs at the shoulder. Pelage full and soft.

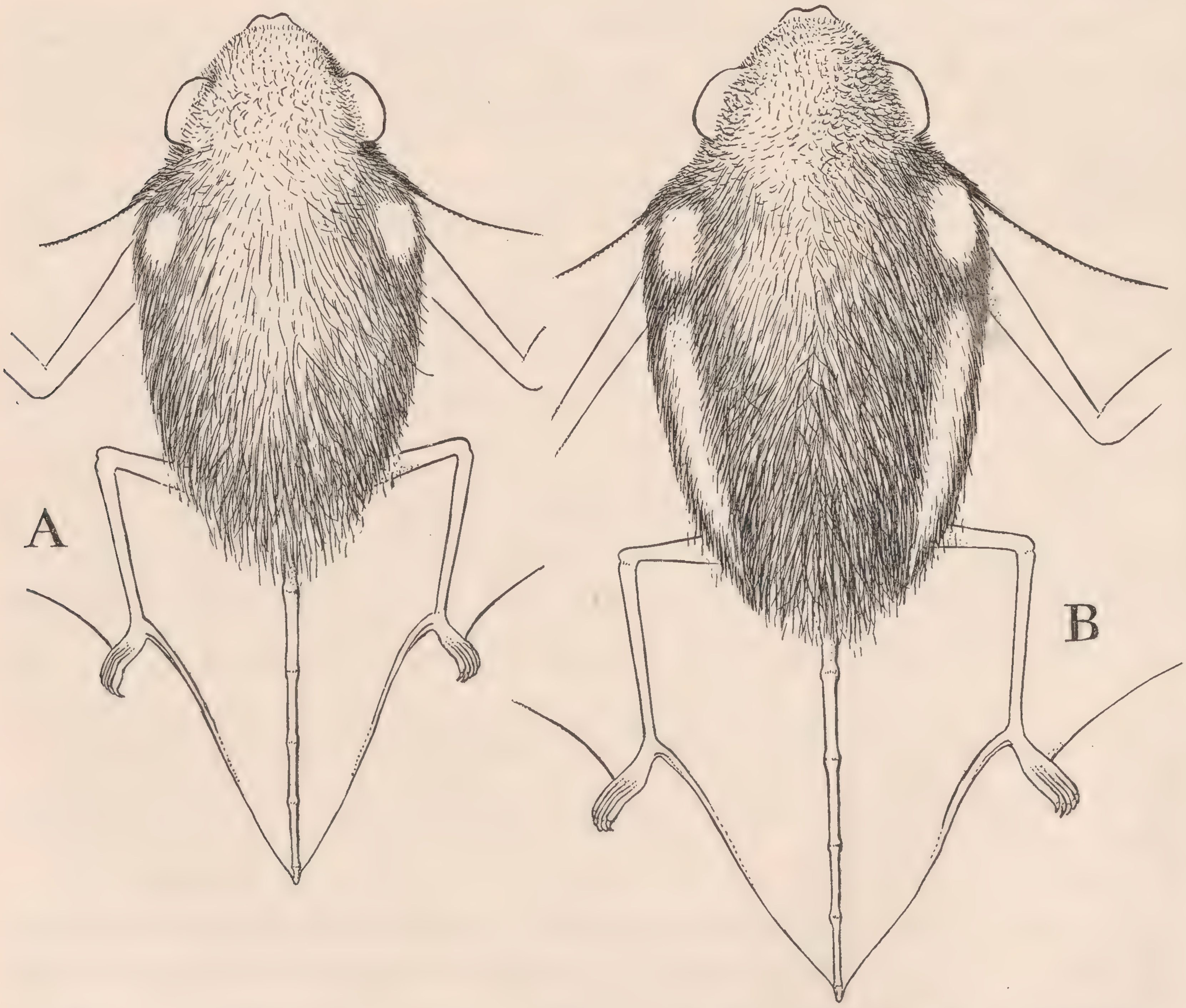


Fig. 7. Sketches of (*A*) *Glauconycteris humeralis*, male (No. 49315), and (*B*) *G. alboguttatus* sp. nov., type, female (No. 49317), to show white markings of shoulders and back. $\frac{1}{1}$.

Upperparts hair-brown, the hairs darker on basal half; a conspicuous tuft of white hairs on the shoulders; underparts similar to back but paler; membranes dark brown; limb bones pale brown on both surfaces; wing membranes attached to the whole length of basal joint of outer toe; no postcalcaneal lobe. Ears small, yellowish brown; tragus short, broad, straight on inner border, convex on outer border, expanded at middle. Tail wholly included in the interfemoral membrane.

Represented by 5 specimens, the type and 3 topotypes (2 of them in alcohol) from Medje, the other from Avakubi, collected Feb. 21, 1914.

Collectors' measurements of type: Total length, 82 mm.; head and body, 42; tail, 40; foot, 8; ear, 9.

Forearm, type (from skin), 36.8; third metacarpal, 35.8; tibia, 26.8; foot, 7; ear, 5 × 6; tragus, 3 × 1. The forearm length in 2 alcoholic topotypes is, ♀ 35.8, ♀ 35.3; the Avakubi specimen, 38.8.

Skull (type), total length, 11.3; zygomatic breadth, 8.2; breadth of braincase, 7.3; interorbital breadth, 3.9; maxillar breadth, 5.1; breadth at base of canines, 3.6; upper toothrow (with canine), 3.6; length of mandible, 7.9; height at coronoid, 2.5; lower toothrow, 3.9. Skull short and very broad, the braincase greatly expanded. Inner incisor large, with the secondary column about one fourth lower than the main cusp; outer incisor inserted posterior to the inner one, minute, about one third of the height of the inner, and wedged in between inner incisor and canine. The single upper premolar is approximately the size of m^3, and quite similar to it in form.

The pure white shoulder tuft is a conspicuous feature in the type and topotypes; it is present in the Avakubi specimen, but only the tips of the hairs are white (yellowish white instead of pure white). The collectors' measurements and the forearm are somewhat larger than in the type, but the skull measurements are practically the same in all the specimens.

46. **Glauconycteris alboguttatus** sp. nov.

Text Fig. 7, *B*.

Type, No. 49317 (and only specimen) adult female in alcohol, Medje, March 14, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2351.

Upperparts seal brown; underparts slightly paler. A patch of lengthened pure white hairs on each shoulder at base of humerus, about 8 mm. long by 5 mm. in width, separated for about 10 mm. by dark fur from a second patch of white hairs of similar extent but the area longer and narrower. They are symmetrical on both shoulders and conspicuous when the fur is floated out in clear alcohol. Muzzle, chin and sides of face nearly naked and whitish. Propatagium and outer border of wing whitish; forearm and phalangeal bones light brown above and nearly white below. Ears blackish externally, whitish internally. Membranes and feet blackish brown, interfemoral lighter below than above.

Total length, 94; head and body, 52; tail, 42; forearm, 41.5; third metacarpal, 38.6; thumb, 5.6; tibia, 18.3; foot, 8; calcar, 11; ear from crown, 7; from notch, 13; tragus, 5 mm. high by 2.5 in greatest width, broad lunate, with a small angular lobe at posterior base.

Skull, total length, 13.2; condylobasal length, 13; zygomatic breadth, 10; breadth of braincase, 7.4; interorbital breadth, 4.8; maxillar breadth, 6.5; breadth at base of canines, 4.8; upper toothrow (c–m^3), 4.5; length of mandible, 9.5; angle to condyle, 2; depth at coronoid, 2.9; toothrow (c–m_3), 5.2.

Similar to *Glauconycteris humeralis* but larger (the forearm 4 mm. longer and the skull fully one half larger in volume), and with two clear white spots on the shoulder (one behind the other) instead of one, and a very much broader tragus. In size it is similar to *G. congicus* (Noack) but differs from it widely in coloration.

47. **Miniopterus breyeri vicinior** subsp. nov.

Type, No. 49019, ♂ ad., skin and skull, Aba, northeastern Belgian Congo, Dec. 16, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1770.

Differs from *M. breyeri breyeri* in slightly smaller size and in the absence of white on the pubic region.

Upperparts dark drab, the hairs unicolor from base to tip; underparts paler, grayish drab, the hairs dark brown basally with grayish brown tips; the pubic region fulvous; ears and membranes dark brown. Limb bones ventrally light yellow brown; calcar yellowish white.

Wing membranes attached at or slightly above ankle; no post-calcar lobe. Ears very small, uniformly convex on outer and upper border, posterior border nearly straight. Tragus long, narrow, with parallel edges, 4.8 mm. long by about 1.5 mm. wide.

Collectors' measurements of type: Total length, 100 mm.; head and body, 52; tail, 48; foot, 11; ear, 11. Forearm (from skin), 43.2; third metacarpal, 40; tibia, 28; foot, 8.8; ear, length, 6.5, width, 7.5.

Skull (type), total length, 14.8; zygomatic breadth, —; breadth of braincase, 7.5; interorbital breadth, 3.8; maxillar breadth, 5.6; breadth at base of canines, 3.8; maxillary toothrow (with canine), 5.1; length of lower mandible, 10.4; height at coronoid, 3.2; lower toothrow, 6.3.

Represented by 17 specimens (skins and skulls), all adult, and all taken at Aba, Dec. 16, 1911.

Collectors' measurements, 8 males and 8 females:

	Total length	Head and body	Tail	Foot	Ear
♂	101 (94–105)	54.5 (51–59)	46.3 (43–49)	10.6 (10–11)	10.6 (10–11)
♀	103 (96–108)	54.0 (50–57)	49.0 (46–50)	10.5 (10–11)	10.7 (10–11)

Forearm, from skins, same specimens, ♂ 43.6 (42–44.7), ♀ 44.2 (43.4–44.9).

Skull, 5 males, 6 females: Total length, ♂ 14.6 (14.3–15), ♀ 14.7 (14.4–14.9); breadth of braincase, ♂ 7.4 (7.2–7.6), ♀ 7.5 (7.3–7.7).

The present form is similar in general coloration to *M. breyeri breyeri,* from the Waterberg District of the Transvaal, with two topotypes of which the present series has been compared. The pubic region is pale fulvous, however, instead of white, and the average size is considerably less, the forearm in *breyeri* having a length (3 specimens) of 46 mm. and in *vicinior* (16 specimens) 43.5, the largest specimen of the latter being smaller than the smallest of the *breyeri* specimens. Jameson [1] gives the length of the skull in *breyeri* as 15.5; the average in *vicinior* is 1 mm. less, only one in a series of 12 skulls reaching 14 mm.

M. breyeri vicinior is readily separable from the *M. natalensis* group by its paler, much browner coloration and by other features, as shown by direct comparison with typical *natalensis* and with topotypes of *natalensis arenarius.*

48. **Miniopterus inflatus** *Thomas.*

Text Figs. 23 and 24 (pp. 540, 541).

Miniopterus inflatus Thomas, Ann. and Mag. Nat. Hist. (7), XII, p. 634, Dec. 1903. Efulen, Camaroons.

Thirteen specimens (9 males, 4 females, all adult, in alcohol), Thysville, Lower Congo (midway between Matadi and Leopoldville), June 2, 1915.

Forearm, 9 males, 45.2 (44.3–46), 4 females, 44.4 (44.2–44.9). Five skulls (3 males, 2 females), total length, ♂ 15.9 (all 15.9), ♀ 15.5 (15.3–15.7); zygomatic breadth, ♂ 8.63 (8.6–8.7), ♀ 8.65 (86–87). The females are slightly smaller than the males.

Pelage uniform blackish brown (nearly black) both above and below; ears and membranes dark brown, somewhat lighter colored than the body. (Figs. 23 and 24, pp. 540, 541, head of male, and left wing showing the tip folded.)

These may doubtless be safely referred to *M. inflatus,* described from an adult male skin from "Efulen, Cameroons," of which the forearm length is given as 46 mm. and the greatest length of the skull as 16.7, the latter slightly more than the largest of my series of five skulls.

---

[1] Ann. and Mag. Nat. Hist. (8), IV, p. 471, Nov. 1909.

49. **Kerivoula cuprosa** *Thomas.*

Text Fig. 8.

Kerivoula cuprosa Thomas, Ann. and Mag. Nat. Hist. (8), X, p. 41, July, 1912. Bitye, Ja River, southeastern Cameroons.

Three specimens: Akenge, 2, an adult female and young (the latter found hanging to the mother) in alcohol, Oct. 7, 1913; Medje, 1, adult male, skin and skull, June 7, 1914.

The collectors' measurements of the Medje specimen are as follows: Total length, 90; head and body, 45; tail, 45; foot, 7; ear, 14. These measurements are practically identical with the field measurements of the type of the species, as given by Thomas (*l. c.*).

Measurements of the male in alcohol, from Akenge. Total length, 82; head and body, 42; tail, 40; foot, 5.7; ear (from crown), 9.3, from notch, 10.

Forearm, ♀ 34.5, ♂ 34.4; third metacarpal, ♀ 33.5, ♂ 32.8.

Skull, total length, ♀ 13.5, ♂ 13.6; zygomatic breadth, ♀ 12.4, ♂ 12.7; upper toothrow (c–m^3), ♀ 5.4, ♂ 5.2; in the type (from Thomas, *l. c.*), 5.1. The only skull measurements given of the type are those of the upper and lower toothrows.

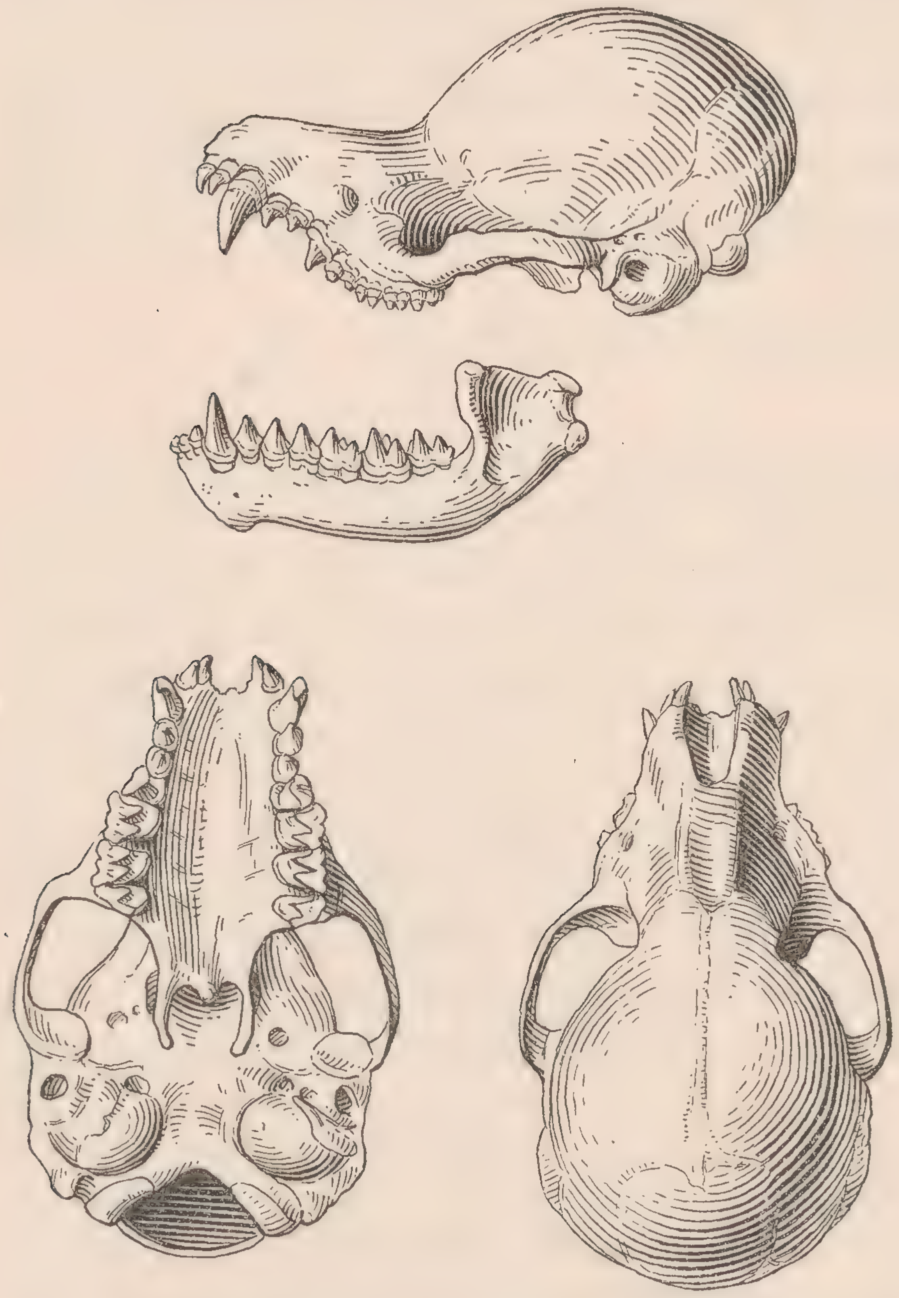


Fig. 8. *Kerivoula cuprosa* Thomas. Skull of adult female (No. 49336). $\frac{3}{1}$.

In respect to coloration and other external characters these specimens agree closely with the description of the type.

The species has been previously recorded from Avakubi, near the present localities, by Dollman (Rev. Zoolog. Africaine, IV, p. 76, July, 1914).

The accompanying figures of the skull are from the female. The two skulls do not differ in any marked way, except that the male has a much more strongly developed sagittal crest.

MOLOSSIDÆ.

50. **Myopterus**[1] **albatus** *Thomas.*

Plate LIII, Fig. 2.

Myopterus albatus THOMAS, Ann. and Mag. Nat. Hist. (8), XVI, p. 469. River Welle, Belgian Congo.

Seven specimens (6 skins with skulls, 1 alcoholic), Niangara, December 26, 1910. Six are adult females, the other an immature male.

Collectors' measurements of 5 adult females: Total length, 126 (123-132); head and body, 85 (80–90); tail, 41 (40–42); foot, 13.8 (13–14); ear, 23 (22–24).

Forearm (in dry skins), same specimens, 53.7 (51.5–56). Ear (from crown on midline), 14 (13.5–14.5).

Skull (same specimens), total length, 25.2 (24.2–25.7); zygomatic breadth, 14.5 (14.1–14.7).

Myopterus albatus was described from a skin, without skull, collected by M. Hutereau, on the Uele River, Belgian Congo (type in the Congo Museum, Tervueren, Belgium). The present specimens, from near the type locality, are confidently referred to this species. The light bands on the sides of the back are more yellowish (less whitish) than is indicated in the original description, as are also the entire underparts, and the wing membranes are pale yellow instead of "white," as described.

51. **Nyctinomus ansorgei** *Thomas.*

Nyctinomus ansorgei THOMAS, Ann. and Mag. Nat. Hist. (8), XI, p. 318, March, 1913. Malange, North Angola. Alt. 1150 m.

Twenty-six specimens (9 skins and skulls and 17 in alcohol) all taken at Faradje, February 20, 1912.

Collectors' measurements of 9 adults: Total length, 110.5 (105–115); head and body, 75 (72–79); tail, 35 (31–37); foot, 11.6 (11–12); ear, 20.9 (20–21).

Forearm, from the same 9 skins, 46 (45–47); forearm from 16 alcoholic specimens (4 males, 12 females), ♂ 46.7 (45.4–48.4), ♀ 46.4 (45.5–48).

---

[1] On the use of *Myopterus* Geoffroy in place of *Eomops* Thomas, see Miller, Families and Genera of Bats, 1907, p. 245, and Thomas, Ann. and Mag. Nat. Hist. (8), XVI, p. 468, 1915.

Measurements of an adult male skull: Total length, 19.5; condylobasal length, 18.2; zygomatic breadth, 11.9; mastoid breadth, 10.7; breadth of braincase, 9.2; interorbital breadth, 3.9; maxillar breadth, 7.7; upper toothrow (including canine), 7.1; length of mandible, 12.8; depth at condyle, 3.7; lower toothrow, 7.8.

Average of 7 adult skulls: Total length, 19.4 (18.8–19.9); zygomatic breadth, 11.6 (11.2–12.2.)

The description of *N. ansorgei* so completely agrees with the present series that it might well have been based on any one of several of the specimens here recorded.

52. **Nyctinomus leonis** *Thomas.*

Nyctinomus leonis Thomas, Ann. and Mag. Nat. Hist. (8), II, p. 373, Oct., 1908. Sierra Leone.

Two specimens, an adult female, skin and skull, Panga, Sept. 8, 1910; an adult male in alcohol, Medje, Jan. 25, 1910.

Collectors' measurements of the female from Panga: Total length, 106 mm.; head and body, 74; tail, 32; foot, 11; ear, 17. Forearm (from skin), 39.4.

Skull, total length, female 18.7, male 20; condylobasal length, 17.3, 18; zygomatic breadth, 12, 12.4; mastoid breadth, 10.6, 11.2; interorbital breadth, 3.7, 4; maxillar breadth, 8.6, 8.4; breadth at base of canines, 5.3, 5.8; length of upper toothrow (with canine), 6.9, 7.1; length of mandible, 12.9, 12.9; depth at condyle, 3.5, 4.7; length of lower toothrow, 7.5, 8.2. First lower premolar about half the size of the second.

Female skin: above dark chocolate brown, almost blackish brown, the hairs lighter at base; throat pale yellow; sides pale brown; rest of lower parts pale yellowish white. Ears and membranes deep black. A short narrow band of dark brown fur at junction of forearm and humerus. Edge of upper lip conspicuously furrowed, the anterior grooves about 3 mm. in length.

The skull has the sagittal and lambdoid crests well developed, much heavier in the male; the strong development and backward extension of the lambdoid strongly suggests the condition of the occipital region in *Allomops*, as does also the larger size of the male as compared with the female.

These specimens are doubtfully referred to *N. leonis* (type locality, Sierra Leone). Both have a tuft of lengthened black hairs on the front of the crown, close to the base of the connecting membrane of the ears, the longest of which in the male have a length of 10 mm.

53. **Nyctinomus cisturus** *Thomas.*

Nyctinomus cisturus THOMAS, Ann. and Mag. Nat. Hist. (7), XII, p. 502, Nov. 1903. Mangala, east bank of Nile, 25 miles north of Gondokoro, Kordofan.

One specimen, No. 48842, subadult male, skin and skull, Niangara, Dec. 10, 1910.

This specimen agrees so completely with the description of *N. cisturus* (type locality, Mangala, 25 miles north of Gondokoro on the upper Nile River), that it may be confidently assigned to this species, although the presence of the large anal gland, noted in the description of the unique type, cannot be positively determined from the skin.

Collectors' measurements: Total length, 128 mm.; head and body, 95; tail, 33; foot, 12; ear, 19. Forearm (from skin), 46.6.

Skull, total length, 19.5; condylobasal length, 17.8; zygomatic breadth, 11.5; mastoid breadth, 10.6; maxillar breadth, 8; breadth of braincase, 9.3; upper toothrow (c–m^3), 6.8.

Above dark brown; below similar, without white on the median line, but with a narrow edging of white at base of wing membranes between humerus and femur. Wing membranes above blackish brown proximally, lighter brown and translucent beyond the fourth digit.

54. **Nyctinomus ochraceus** sp. nov.

Type, No. 48821, ♀ ad. (skin and skull), Medje, March 16, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 745.

Ears thick, united at base in front. Coloration unusual for a molossid.

Above, superficially, dark chestnut-brown, the hairs ochraceous-buff basally, showing more or less at the surface, especially on the shoulders and sides of the neck where it often gives the prevailing tone to the coloration; below orange, varying in tone in different specimens from pale to deep orange. A tuft of lengthened dark chestnut-colored hairs on the front part of the crown behind the connecting membrane of the ears. Ears blackish brown. Membranes naked; wing membranes from upper part of tibia; face naked, brownish. Interfemoral membrane narrow, much more than half the tail free. Tragus small, narrow and pointed, a little higher than wide. Antitragus low, evenly rounded above, broader at base than high, about 5.5 × 4.5 mm.

Collectors' measurements of type: Total length, 105 mm.; head and body, 72; tail, 33; foot, 11; ear, 18. Forearm (in skin), 37.7.

Collectors' measurements of type and 16 topotypes; Total length, 103 (100–106); head and body, 71.6 (68–73); tail, 31 (29–34); foot, 11 (all 11); ear, 17.5 (17–19). Forearm, same specimens, 38 (37.3–39.3).

Skull (type), total length, 18.6; condylobasal length, 16.6; zygomatic breadth, 11.7; mastoid breadth, 10.8; breadth of braincase, 9; maxillar breadth, 8.3; interorbital breadth, 4; breadth at base of canines, 5.6; length of upper toothrow (with canine), 6.7; length of mandible, 12.2; angle to condyle, 3.6; depth at coronoid, 3.1; length of lower toothrow, 7.4.

Skulls of type and 16 topotypes, total length, 18.8 (18.2–19.4); zygomatic breadth, 12 (11.4–12.5).

Braincase low and flat, sagittal and lambdoid crests slightly developed, the latter indicated only in old adults; preorbital process absent or barely indicated. Premaxillæ emarginate behind base of incisors. Upper incisors small, slightly convergent apically, widely separated from each other and the canines. First upper premolar very small, in midline of toothrow and not crowded between the adjoining teeth. Lower incisors 2–2, small, crowded in a convex row between canines. First lower premolar about half the size of the second. Coronoid process small and low, barely reaching the level of the condyles, and directed outward.

This striking species is represented by 22 specimens, 18 skins with skulls and 4 in alcohol, all taken the same day at Medje, and all adult. Only 4 are males, and of the 14 female skins 11 are labeled as "carrying an embryo in right uterus." One of the alcoholic specimens is in poor condition, the ears and membranes being abraded and light colored, and the orange of the underparts is faded to pale yellow. This specimen was taken at first to represent a different but (owing to its condition) an unidentifiable species, and was so listed in this paper, but Mr. Lang assures me that this is one of the 22 specimens of *N. ochraceus* taken at Medje, all on the same day, and that its present abraded and bleached condition is due to bad preservation due to an accident in transportation.

Nyctinomus ochraceus appears to be related to *N. thersites* Thomas but it is smaller (forearm 38, in *thersites* 41; skull 18.8 × 12; in *thersites* 20 × 12.5), and the lower premolars are not subequal as in *thersites*. *N. thersites* is described as "colour dark brownish chestnut, the glandular hairs behind the junction of the ears black." This applies fairly well to the upperparts of *N. ochraceus*, except that the lengthened hairs behind the ears in males are not black but dark chestnut. It is hardly possible, however, that this brief description could apply if the lower parts had been ochraceous-orange, as in the species here described.

55. **Chærephon frater** sp. nov.

Type, No. 49275, ♀ ad. (alcoholic), Malela (near Boma), southwestern Belgian Congo, July 8, 1915; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2613.

Similar to *Chœrephon hindei* in general coloration but smaller, skull less massive and the dentition weaker, with p^2 much smaller.

Coloration, including the wing membranes, practically the same as in *C. hindei*, so far as can be determined from alcoholic material, except that the proximal border of the wing membranes, between the humerus and femur, is without the white band of fur seen in *hindei.*

Entire body dark brown except a broad, usually well-defined pure white median area from opposite the shoulders to base of tail, covering about one-third of the ventral surface of this part of the body, varying somewhat in extent in different specimens. Wing membranes white above, except proximately from elbow to knee where they are brownish, the tone deepening toward the body; below wholly white. Interfemoral membrane brown both above and below. Ears joined by a deep membrane, fringed above with short stiff hairs about 0.5 to 1 mm. in length, and similarly covered in front and on the central part of its posterior face. Tragus minute, quadrate, about 1 mm. square. Antitragus rounded above, about 2.5 mm. in height and about 3 mm. wide at base. In 18 of the 22 well-preserved alcoholic specimens the front half of the crown behind the membrane joining the ears is naked; in the other four this area is slightly covered with fine fur. The ears are thinner and broader than in *C. hindei.*

External measurements of the type: Total length, 80 mm.; head and body, 50; tail, 30; forearm, 37; third metacarpal, 35.5; thumb to base of the prominent pad, 6; tibia, 10.5; foot, 7.2; ear from crown, 8.7; from the notch behind the antitragus, 12. Forearm, average of 22 topotypes, 36 (35–37). Forearm in type of *hindei*, 40; in five specimens from near the type locality, 37.6 (37–39.4).

Skull, type (corresponding measurements of type of *hindei* in parenthesis): Total length, 15.2 (17.6); zygomatic breadth, 9.4 (11.4); upper toothrow, 5.4 (6.7).

Seven skulls (removed from alcoholic specimens), 1 male and 6 females, measure as follows: Total length, 15.9 (15.4–16.4); condylobasal length (4 skulls), 14.3 (13.8–14.8); zygomatic breadth, 9.5 (9.0–9.9); mastoid breadth, 8.9 (8.7–9.2); breadth of braincase, 8.3 (7.9–8.4); interorbital breadth, 3.4 (3.3–3.6); breadth at base of canines, 4.2 (3.6–4.5); maxillar breadth, 6.8 (6.4–7.8); upper toothrow (c–m^3), 5.4 (5.2–5.6); length of mandible, 10.1 (9.5–10.6); angle to condyle, 2.5 (2.3–2.9); depth at coronoid, 2.6 (2.2–2.9); lower toothrow (c–m_3), 5.9 (5.6–6.1).

Represented by 22 specimens in alcohol, all from Malela, the type locality.

Six skulls of *C. hindei*, two from the type locality (Fort Hall, B. E. Africa) and three from a nearby point (collection of United States National Museum) measure as follows (the corresponding measurements of six skulls of *C. frater* are given in brackets): Total length, 17.5 (17.3–18) [15.9 (15.4–16.4)]; zygomatic breadth, 10.6 (10.5–10.8) [9.5 (9.2–9.9)]; length of mandible, 11.4 (11.2–12) [10.1 (9.5–10.6)]. A single skull from Mombasa (collection of Museum of Comparative Zoölogy), exactly agrees in measurements with the average of the five from the Fort Hall region.

In general form the skull is a miniature of that of *C. hindei* but disproportionally weaker, especially in respect to the mandible and dentition. In four of the seven skulls examined, the premaxillæ are fully ossified, as in typical *Chærephon;* in the others there is a U-shaped vacuity behind the incisors and the incisors are not united by an osseous border. In this species, as in *C. abæ* and some other species of *Chærephon* of which I have been able to examine a series of skulls, a similar condition exists, the younger specimens often having the premaxillæ imperfectly ossified at the incisive border. In one skull p^2 is in the toothrow on the left side, but on the right side is on the outer edge of the toothrow, as it is on both sides in all of the other five skulls. Usually p^2 separates the canine from p^4, but in two instances p^2 is crowded so far out that the canine and p^4 are in contact. The first lower premolar is about one-third smaller than p_4.

The nearest known form to *C. frater* is *C. hindei* (type locality, Fort Hall, Kenya district, British East Africa), from which *frater* differs in smaller size, especially in the smaller size of the skull and much weaker dentition. It also differs in color, particularly in having a larger area of white on the middle of the belly and in the absence of white on the proximal border of the wing membranes. As shown above, in a series of six skulls of each form, the extreme measurements do not overlap, the smallest *hindei* skull being considerably larger than the largest *frater* skull. The males of *hindei* have a low broad tuft of dark hair behind the membrane joining the ears, arising from the front part of the crown (not from the back of the frontal membrane, as in *Lophomops*), but in *frater* this part of the crown is usually bare in both sexes, and hence of course without the frontal tuft found in the males of *hindei*.

C. frater is about the size of *C. limbatus* (Peters) from Mozambique, with which it shares the character of white wing membranes, but *limbatus* evidently (judging from descriptions) belongs to a different section of the genus (*Lophomops*), the males being said to have a "long crest of erect hairs behind the connecting membrane of the ears" (de Winton). The absence of white on the lower parts and the character of p^2 would also exclude *limbatus* from further consideration in this connection.

56. **Chærephon russatus** sp. nov.

Text Fig. 25, p. 550.

Type, No. 48925, ♂ ad., skin and skull, Medje, Belgian Congo, Sept. 8, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 993.

Above uniform russet-brown, with a large median nearly hairless spot at shoulders; below cinnamon-brown, the extreme tips of the hairs on the median area faintly lighter in some specimens but as a rule not appreciably so; a band of cinnamon-brown bordering the underside of wing membrane between humerus and femur; wing membrane (in dry skins) dark brown proximally as far as the fourth digit, the outer portion slightly paler and semitranslucent; uropatagium dull brown, both above and below. Ears thickened on front border, blackish brown, united by a membrane at base, which projects as a rounded protuberance in front of the ears. Tragus minute, narrow, about 3.5 mm. high by about 1 mm. wide, blackish. Antitragus rather small, about 5 mm. wide at base and 3.5 in height, evenly rounded above. Tail about 34 mm. in length, the apical half free, the basal third below furred. Pad at the base of the thumb large. (For illustration of wing see Part II, p. 550, by Lang and Chapin.)

Collectors' measurements of type: Total length, 102 mm.; head and body, 68; tail, 31; foot, 10; ear, 21. Additional measurements from the dry skin: Forearm, 45.7; third metacarpal, 45.4; tibia, 38; foot, 10.5; ear, length of outer border, 25.7; height from crown, 19.3.

Collectors' measurements, type and 23 adult topotypes (4 males, 20 females): Total length, 100 (93–105); head and body, 67.8 (62–73); tail, 33.1 (29–36); foot, 11.2 (10–13); ear, 20.2 (19–22). Forearm, from the skins (same specimens), 44.6 (42–46).

Skull rather deep and narrow; median and lambdoid crests weakly developed, especially the former; preorbital ridge conspicuous; premaxillæ fully ossified, enclosing a pair of small palatal foramina. Upper incisors small, slightly separated at base with their tips nearly or actually in contact (in different specimens); lower incisors $\frac{2-2}{2-2}$, small, all bifid, the inner more deeply so than the outer with the inner lobe the larger; outer incisors partly posterior to the middle pair. Upper canines with a broad, deep longitudinal groove and small cingulum without cusps; lower canines without distinctive features. First upper premolar minute, closely crowded between the adjoining teeth and wholly separating them; second upper premolar large, more than half the size of m^1; first lower premolar a little smaller than the second.

Skull (type), total length, 18.7; condylobasal length, 16.6; zygomatic breadth, 11; mastoid breadth, 10.1; interorbital breadth, 4.1; maxillar breadth, 7.9; breadth of braincase, 9.3; upper toothrow (with canine), 6.4; length of mandible, 12.2; angle to condyle, 2.5; depth at coronoid, 3; lower toothrow, 7.

Skull, type and 22 topotypes, total length, 18.5 (17.8–19.4); zygomatic breadth, 11 (10.5–11.4).

Represented by 27 specimens (24 skins with skulls, 3 alcoholic), all taken at Medje, September 8, 1910.

The series is exceedingly uniform in both coloration and measurements. The pelage of the dorsal surface is without light tips to the hairs, and the pelage of the ventral surface is nearly so, a few of the specimens, however, having the extreme tips of the hairs pale buffy over the median area.

Chærephon russatus closely approaches *C. demonstrator* (Thomas) in size and proportions, but the latter is somewhat larger, especially in cranial measurements, the zygomatic breadth being about 2 mm. greater. The upper canine and second upper premolar are said to be in contact in *C. demonstrator,* with the minute first premolar in the outer angle between them, while in *russatus* the small premolar is in the middle of the toothrow, completely separating the canine from p^4. The description of the coloration of *demonstrator* also does not agree well with that of *russatus,* nor does the indicated structure of the ears. The fleshy protuberance in front of the ears seen in *russatus* is found also in other species, which in other respects are widely different. It is said not to be present in *demonstrator.* In an alcoholic male of *russatus* there is no indication of the pair of scent glands at the base of the penis, mentioned as a distinctive feature of the unique type of *demonstrator.*

57. **Chærephon** sp. indet.

One specimen, semiadult male, skin and skull, Avakubi, Dec. 28, 1913.

Collectors' measurements: Total length, 109 mm.; head and body, 71; tail, 38; foot, 12; ear, 22. Forearm, from skin, 48; skull, total length, 20.4; zygomatic breadth, 10.5.

Color above russet; underparts ochraceous tawny. Ears and wing membranes wholly blackish brown; limb-bones blackish above, whitish below.

Evidently fully adult as regards coloration and other external features, except that the phalangeal epiphyses are still free, the outer milk incisors and the right milk p^2 are still present, and the frontal bones are not united on the midline, but the rami are firmly joined. The cranial and external measurements are consequently somewhat below normal adult size.

This specimen is possibly referable to *Nyctinomus aloysii-sabaudiæ* Festa, from Torro, Ruwenzori, but this species is not identifiable from the description given, no mention whatever being made of the skull, and the coloration is given simply as clear chestnut ("castagno chiaro" = *russet* del Ridgway"), the hairs lighter basally, with no indication that the underparts are lighter than the back, or ochraceous tawny, as in the present specimens. The measurements would apparently agree with an adult example of the present form. Geographical considerations, however, indicate that the two forms should not be closely related.

The nearest species to this specimen in the present Congo Collection is *Chœrephon russatus,* from Medje, from which it differs in being much larger, and strikingly different in coloration.

Lophomops subgen. nov.

Text Figs. 9–11.

Type *Chœrephon* (*Lophomops*) *chapini* sp. nov.

Skull and dentition as in the smaller species of *Chœrephon,* but outer lower incisors often deciduous, giving an incisive formula of $\frac{1-1}{1-1}$ instead of $\frac{1-1}{2-2}$.

Ears united in front by a deep membrane, from the back of which arises a heavy crest of long straight hairs, occupying the whole posterior face of the membrane and rising above the tops of the ears as a broad frontal transverse crest, the hairs of which are dark brown for the basal half and lighter brown or (in one of the species, selected as the type) white for the apical half. It is apparently a sexual character, but only males have thus far been examined except in the rather aberrant *C.* (*L.*) *abæ.* For decorative effect, especially when the crest hairs are particolored — rufous at base and pure white for the apical half, as in *C.* (*L.*) *chapini* — it vies with the spectacular head ornamentation occurring in many groups of birds.

The taxonomic value of *Lophomops* may be open to question. The peculiar character of the crest is not only its great size and striking effect, but the fact of its origin being from the whole posterior face of the deep membrane connecting the ears, instead of from the front of the head behind the ears. A number of species of both *Chærephon* and *Nyctinomus* have slightly lengthened tufts of glandular hairs behind the ears arising from the front part of the crown (not from the connecting membrane of the ears), consisting usually of lengthened crinkled hairs, a little longer and coarser than the adjoining fur, and usually of a darker color. These patches of specialized hairs frequently appear to be restricted to males, but in some species are present in both sexes, as is the case with the gular sac. They are, however, inconspicuous in comparison with the crests of the *Lophomops* group. Three species of this group are here described, of which *Chærephon* (*Lophomops*) *chapini* is here designated as the type.

Dysopes limbatus Peters (now regarded as a *Chærephon*) is described by de Winton[1] as having a "long crest of erect hairs behind the connecting membrane of the ears in the males," but he does not say that they arise from its posterior face. Peters does not describe nor does his figure represent any such crest as is seen in *Lophomops*. He simply says: "Die Haare auf dem Kopfe hinter der Vereinigung der Ohren sind länger and steifer als am übrigen Körper." The type locality of *Dysopes limbatus* is Mozambique Island, and it is possible that the specimens de Winton had in hand were not the true *limbatus* of Peters, and are perhaps referable to some form of *Lophomops*. *C. limbatus* (Peters) is probably a near relative of *C. hindei* (Thomas).

58. **Chærephon (Lophomops) chapini** sp. nov.

Text Fig. 9.

Type, No. 48841, ♂ ad. (skin and skull; topotype, No. 49209, ♂ ad., alcoholic), Faradje, northeastern Belgian Congo, Nov. 11, 1912 (topotype, Jan. 12, 1913); Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1971.

Head in males conspicuously crested, the crest arising from the posterior face of the deep membrane connecting the ears; breadth of the crest at base, 8.5 mm.; length of crest, 13 mm. in type, 14 in topotype; basal half reddish chestnut, apical half white; breadth of crest across the top when expanded (Figs. 9, *A*, *B*, *C*) about 20 mm. A broad tuft of soft whitish hairs covers the front of the crown behind the crest. Body above pale cinnamon-brown, the fur whitish basally; below grayish brown, the middle of the belly whitish; a narrow band of white at proximal edge of wing membranes, between humerus and femur, continuous with a similar band at base of uropatagium; wing membranes white, becoming yellowish proximally; the portion adjoining the body, between humerus and femur, thickly punctated with minute blackish specks; interfemoral membrane dark brown above and below; limb bones dark brown above, in strong contrast with the light colored membranes, below light brown like the membranes; tail blackish. No gular pouch.

---

[1] Ann. and Mag. Nat. Hist. (7), VII, p. 39, Jan., 1901.

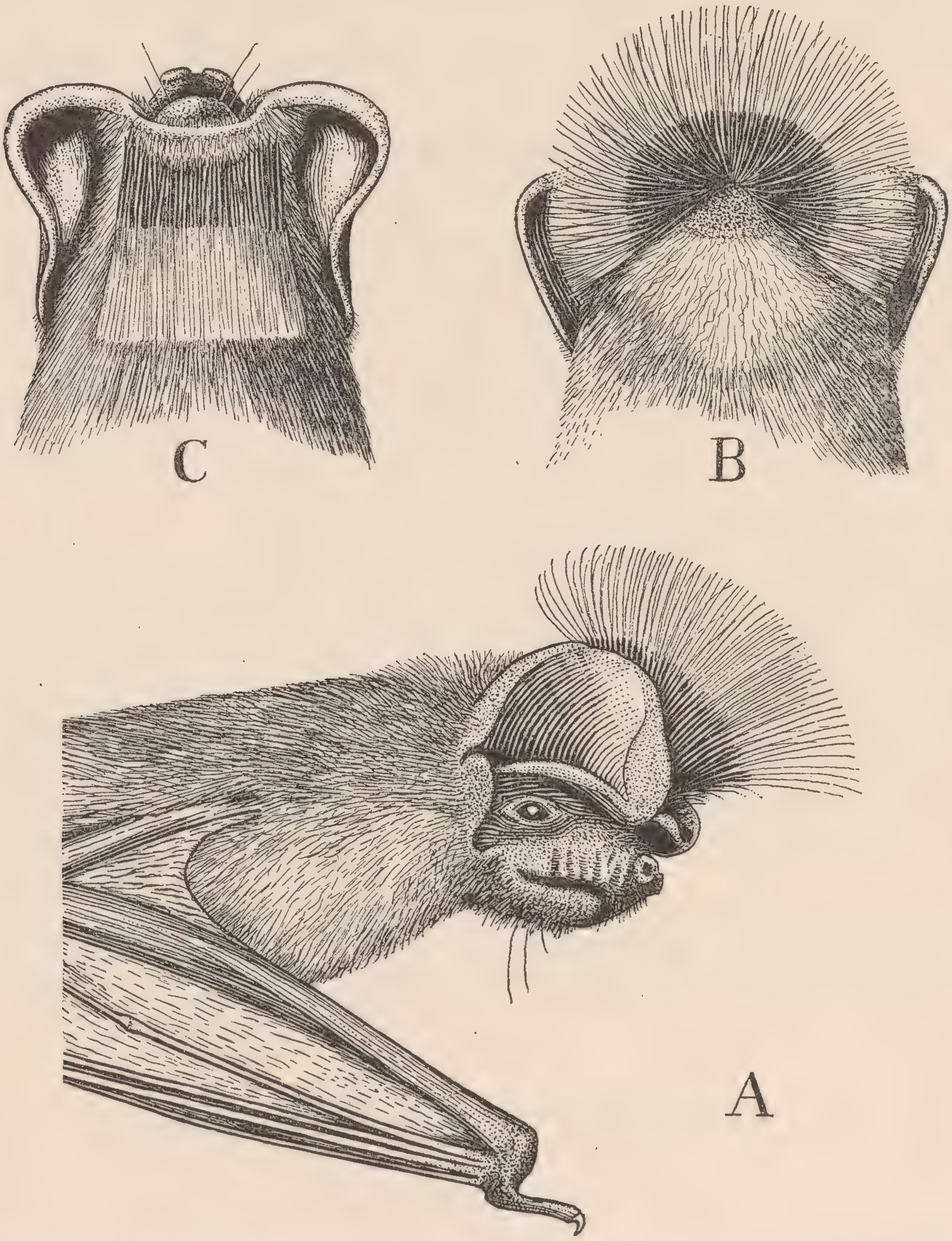


Fig. 9. *Chærephon (Lophomops) chapini.* Adult male (type), No. 48841). *A*, side view of head, crest erect; *B*, view of crown, crest erect; *C*, same view, crest laid back. All $\frac{3}{2}$.

Collectors' measurements of type: Total length, 84 mm.; head and body, 56; tail, 28; foot, 7; ear, 14. Additional measurements from the dry skin: Forearm, 34; third metacarpal, 37; ear from crown, 8.5. Tragus minute, quadrate, about 1.5 square; antitragus small, about 5 broad at base and 3 high.

Measurements of the alcoholic topotype: Total length, 80; head and body, 48; tail, 32; forearm, 37; third metacarpal, 39; third digit, 72; tibia, 11.8; foot, 7.7; ear from crown, 9.5, from notch behind antitragus, 12.8; expanse of both ears from tip to tip, 27.

Skull (measurements of topotype in parenthesis), total length, 15.5 (16); zygomatic breadth,— (9.5); interorbital breadth, 3.5 (3.5); mastoid breadth, — (9); breadth of braincase, 7.6 (7.7); maxillar breadth, 6.5 (6.8); upper toothrow (c–m^3), 5.4 (5.8); length of mandible, 10 (10.4); angle to condyle, 2.6 (2.6); depth at coronoid, 2.6 (2.6); lower toothrow, 5.9 (6.4). Upper incisors parallel, slightly separated, a wide space between them and the canines; lower incisors bifid, 1–1 (in both type and topotype), completely filling the space between the canines. First upper premolar minute, in the toothrow, separating the canine and p^4; first lower premolar smaller and with much lower crown than the second. Premaxillæ fully ossified; palatal foramina coalesced, forming a small U-shaped vacuity; presphenoid pits deep, slightly longer than wide; preorbital (lacrymal) processes strongly developed; median crest slightly indicated, lambdoid crest moderately strong. In general features the skull is as in other small species of *Chœrephon.*

Chœrephon (*Lophomops*) *chapini* is represented by only the type and a topotype, both old males from Faradje. It evidently has no close relationship to any known species. Its conspicuously heavy and long particolored crest distinguishes it at once from the other known species of the *Lophomops* group.

59. **Chærephon (Lophomops) cristatus** sp. nov.

Text Fig. 10, *A*, *B*.

Type, No. 48844, ♂ ad. (skin and skull), Boma, near mouth of Congo River, Belgian Congo, Jan. 26, 1915; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2628.

Head crested, the crest arising from the posterior face of the deep membrane uniting the ears. Crest (Fig. 10, *A*, *B*) shorter than in *C. chapini*, the hairs reddish apically, the basal half darker, the transition between the two tones abrupt. Whole top of the head behind the crest naked, but covered by the crest hairs when the crest is laid back. Body above uniform russet, the basal portion of the fur but little lighter than the tips; underparts dark cinnamon-drab, the middle area with light tips to the hairs, in contrast with the sides; an indistinct median whitish band from the pectoral region posteriorly; a narrow band of soft white fur along the inner edge of the wing membrane from the humerus to the femur and continued across the lower abdomen at base of the uropatagium. Face and gular region naked and blackish, bordered below by a naked flesh-colored band. Wing membranes as in *C. chapini* but whiter, the upper surface in strong contrast with the blackish limb bones; the dorsal side of the membrane along the sides of the body, between humerus and femur, thickly set with blackish dots, most of which support a minute bristly hair, visible only under a strong lens, and more obvious than in the specimens of *C. chapini.* Interfemoral membrane dark slaty brown above, somewhat lighter below. No gular pouch. Upper lips corrugated.

Collectors' measurements of type: Total length, 87 mm.; head and body, 56; tail, 31; foot, 9; ear, 13. Additional measurements from the dry skin: Forearm, 36; third metacarpal, 35; tibia, 10; foot, 8.7; thumb, 6; ear from crown, 9.2; length of crest hairs, 9.5.

Three male topotypes (Nos. 49216, 49237, 49359) in alcohol: Total length, 84, 83, 80; head and body, 51.5, 53, 48; tail, 32, 31, 32; forearm, 36, 36.2, 36.4; third metacarpal, 36, 34, 35; third digit, 66. 65, 66.5; ear from crown, 9, 8, 8; height from notch behind antitragus, 14, 13, 13.5; extent of both ears from tip to tip, 28, 29, 29; tibia, 11, 11.5, 11; foot, 7, 6.7, 8; length of crest, 9, 8, 9; width at base, about 6.5.

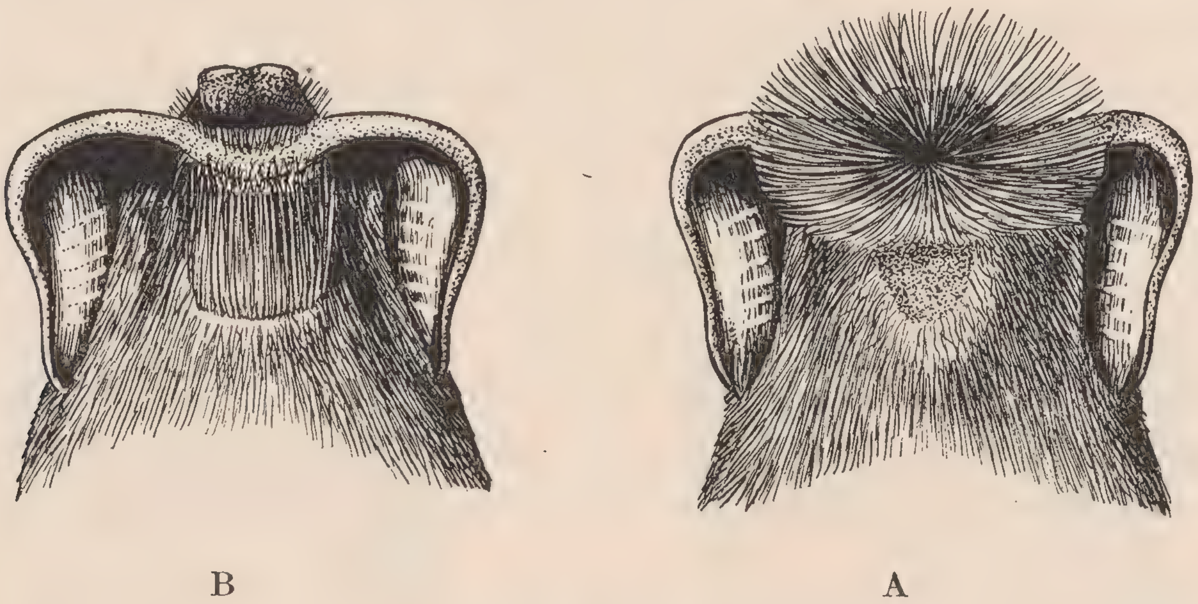


Fig. 10. *Chærephon (Lophomops) cristatus.* Adult male (No. 49259). *A*, crest erect; *B*, crest laid back. All $\frac{3}{2}$.

Skull, type (topotype No. 49216 in parenthesis), total length, 16.3 (16); zygomatic breadth, 9.7 (9.8); mastoid breadth, 9 (9.2); interorbital breadth, 3.6 (3.8); maxillar breadth, 7 (7.2); breadth of braincase, 8 (8); depth of skull at pterygoids, 6 (6.3); upper toothrow (c–m^3), 5.5 (5.7); length of mandible, 10 (10.3); angle to condyle, 3 (3.2); depth at coronoid, 2.8 (2.8); lower toothrow, 6 (6.2).

Chærephon (Lophomops) cristatus is represented by the type and three topotypes, all collected at Boma, January 25–29 and June 15, 1915. The type lacks the middle pair and one of the outer lower incisors, which had been shed in life; one of the topotypes has only the middle pair, which occupies the whole space between the canines; the other has the middle pair and a minute outer incisor on the left side, showing that in the *Lophomops* group the lower incisors are doubtless normally 2–2. This species is slightly larger than *C. chapini* and differs from it strikingly in coloration, aside from the difference in the color and length of the crest.

60. **Chærephon (Lophomops) abæ** sp. nov.

Text Fig. 11.

Type, No. 48887, ♀ ad., skin and skull, Aba, northeastern Belgian Congo, Dec. 17, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1823.

Above hair-brown, with a slight grayish sheen; below a narrow median whitish band from breast to anal region, and a narrow white border at base of wing membranes from humerus to femur; rest of underparts like the back but without the grayish sheen; membranes lightish brown above and below. Male with a conspicuous cinnamon-brown crest, lacking in the female.

Ears thin, dark brown, rising separately from the crown, the intervening space being occupied by an erectile membrane, convex above and about 5 mm. high, from the back of which arises, in the male, a thick mass of brown hairs, about 7 mm. in length and reaching 3 mm. above the crest of the convex membrane (Fig. 11); the basal three fifths of the hairs a darker shade of cinnamon-brown than the apical two fifths; in females (at least in dry skins) the membrane is directed backward, covering the crown, which is naked or covered only with a slight pubescence on the upper border and in front; crown beneath bare (as seen by softening and raising the disk or lappet).[1] The size of the lappet varies in different specimens, being not fully developed in the younger examples.

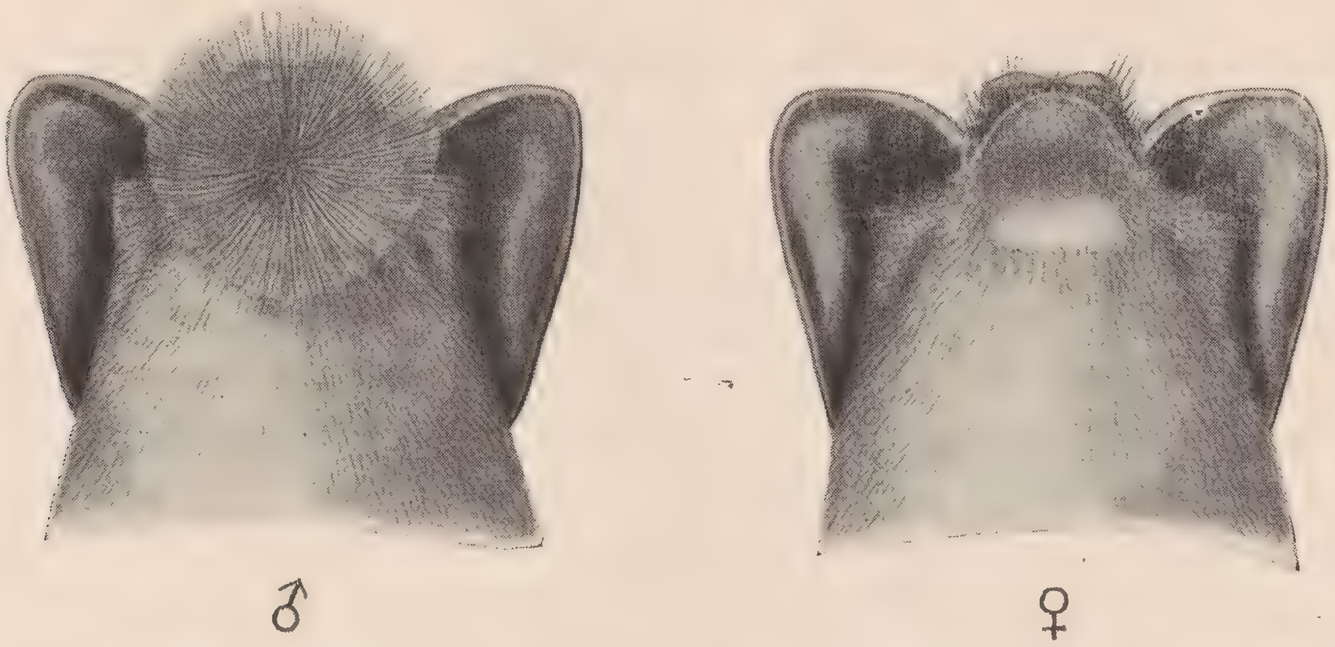


Fig. 11. *Chærephon* (*Lophomops*) *abæ*. ♂, crown view of head, male; ♀, crown of head, female. $\frac{3}{2}$.

Skull with the braincase broad and flat, rising only slightly above the rostral portion of the skull. Sagittal crest weakly developed or barely indicated; lambdoid crest moderate; preorbital processes strongly developed; premaxillæ well ossified in old skulls, but in young adults there is often a small U-shaped vacuity behind the incisors.

Collectors' measurements of type: Total length, 103 mm.; head and body, 69; tail, 34; foot, 10; ear, 17. Forearm (from skin), 43.

Collectors' measurements of type and 22 topotypes: Total length, 102 (97–107); head and body, 67.3 (62–73); tail, 33 (29–35); foot, 10.6 (10–11); ear, 18 (17–19).

Forearm, from skin (same specimens), 42 (40–44).

Skull (type), total length, 18.5; condylobasal length, 17.3; zygomatic breadth, 11.2; mastoid breadth, 10.7; interorbital breadth, 3.8; maxillar breadth, 8.1;

---

[1] Unfortunately there are no alcoholic specimens of this species available for examination, the supply of alcohol having given out on this part of the journey, and the collectors were for some weeks unable to renew it. A considerable number of the skins, however, have been softened for examination, with results as here detailed. The membraneous lappet appears to arise just behind the inner base of the ears and to be not actually joined to them.

breadth at base of canines, 5.4; breadth of braincase, 9; depth of braincase at pterygoids, 6.1; length of upper toothrow (c–m^3), 6.7; length of mandible, 12.3; angle to condyle, 3.5; depth at coronoid, 3.4; length of lower toothrow, 7.6.

Skull, average of 10 specimens, total length, 18 (17.5–18.8); zygomatic breadth, 11.2 (11–11.4); breadth of braincase, 9.2 (8.7–9.8).

Represented by a series of 25 specimens, all collected the same day at Aba. Four additional specimens from Faradje, collected Feb. 25, 1911, are so similar in every respect to the Aba series that they seem preferably referable to the same species. The external measurements are slightly less, but the skulls indicate greater maturity and are as large as those of the Aba series. The coloration, however, is less dark and more buffy. They probably represent a slightly differential local race of the Aba form.

Chærephon (*Lophomops*) *abæ* resembles, in size and coloration, *C. major* (Trouessart), and *C. emini* (de Winton) in size, but not in color. As neither of these species, so far as known, is crested in the males, nor possess the conspicuous and (probably) erectile lappet in the females, and ununited ears, they require no special consideration in the present connection. The uniform brown coloration of the membranes, and usually the size, will readily separate *abæ* from the other known forms of the *Lophomops* group.

61. **Mops**[1] **midas** (*Sundevall*).

Nyctinomus midas Sundevall, Vet. Akad. Handl. Stockholm, 1841 (1842), p. 207, pl. ii, fig. 7, skull and head. White Nile, Africa.

Six specimens (alcoholic), 3 males and 3 females, all adult, Faradje, March 7–9, 1912.

Measurements of an adult female (No. 49272): Total length, 137 mm.; head and body, 95.5; tail, 41.5; forearm, 60.4; third metacarpal, 58.5; tibia, 19; foot, 10.5; ear from crown, 15.6; height from notch at posterior base of antitragus, 24; breadth of both ears from outer border of each, 44.5.

Forearm, average of 6 adults, 60.6 (59.2–64).

Skull massive, narrow and deep, strongly constricted postorbitally, and with a low median crest, highest just in front of braincase. First upper premolar minute, in the toothrow, separating the canine from p^4. Lower premolars subequal, the first slightly lower than the second.

Measurements of skull (♀ ad., No. 49272): Total length, 27.4; zygomatic breadth, 16.4; mastoid breadth, 14.1; breadth of braincase, 12; interorbital breadth, 4.3; breadth at canines, 7.8; upper toothrow (c to m^3), 10.1; depth of skull at pterygoids, 9.6; length of mandible, 18; angle to condyle, 5.8; depth at coronoid, 4.8; lower toothrow (c–m^3), 11.5. Average of 6 adult skulls, total length, 27.2 (27–27.8); zygomatic breadth, 16.5 (16.1–16.8).

---

[1] *Mops* Lesson, 1847, has been revived by Thomas as an available name for a group of Old World free-tailed bats, previously of late referred in part to *Nyctinomus* and in part to *Chærephon*, in a paper bearing the cryptic title (considering the matter it covers), 'On a remarkable new Free-tailed Bat from Southern Bombay.' See Journ. Bombay Soc. Nat. Hist., XXII, pp. 87–91, April, 1913, especially the 'postscript.'

This species is readily distinguishable by its large size and large and thin ears. The pelage is short and thin, the whitish basal portion showing through the pale brown tips of the hairs.

62. **Mops congicus** sp. nov.

Plate LV.

Type, No. 48893, ♀ ad. (skin and skull), Medje, Belgian Congo, Sept. 8, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 966.

Above uniform deep chestnut-brown, the extreme base of hairs rufous; sides of back and lower back naked; below snuff-brown, passing into bister laterally, the extreme tips of the hairs on the middle area buffy; a naked band at base of uropatagium, continuous with the wholly naked hind limbs; wing membranes naked, blackish brown above, a little lighter brown below; interfemoral membrane naked, dull brown above and below. Ears joined by a low membrane, which extends forward as a protuberance in front of the ears; ears thick and leathery, black, with a strong frontal keel; tragus minute, difficult to distinguish in dry skins; antitragus small, low, evenly rounded above, about 5 by 3 mm. Face and chin naked, dark brown; nostrils prominently projecting; upper lip heavily corrugated; thumb with a conspicuous basal pad. A very small patch of fur near outer base of humerus, and a dense patch on inner upper border of ear; outer base heavily furred.

Collectors' measurements of type: Total length, 140 mm.; head and body, 91; tail, 49; foot, 17; ear, 22. Type and 12 adult topotypes; Total length, 138 (131–145); head and body, 93.4 (86–100); tail, 45.3 (41–49); foot, 15.8 (15–17); ear, 22 (20–24). Additional measurements from skins: Type, forearm, 55; third metacarpal, 54; thumb (with claw), 9.3; foot, 15.8; length of ear on outer border, 19; breadth of ear near upper border, 9.5. Forearm, type and 14 topotypes, 55.8 (54.7–57.4).

Skull narrow and deep, heavily ossified; a low continuous median crest from front of interorbital constriction, joining the rather heavy lambdoid; preorbital process weak; braincase with a strong transverse preoccipital depression; basisphenoid pits very deep and large, circular in outline. Upper incisors slightly separated and parallel; lower incisors, middle pair bifid, the outer slender, posterior to the middle pair; canines not specially modified; first upper premolar minute, in the toothrow, separating the canine from p^4; first lower premolar about equal in size to the second.

Skull of type: Total length, 25; condylobasal length, 22.4; zygomatic breadth, 15; mastoid breadth, 13.2; interorbital breadth, 4.7; maxillar breadth, 10.3; breadth at canines, 8.7; breadth of braincase, 11.7; depth of braincase at condyles, 9.5, at bullæ, 10.7; upper toothrow (with canine), 8.9; length of mandible, 19.4; angle to condyle, 5.6; depth at coronoid, 4.6.

Skull, type and 11 topotypes (1 male, 10 females), total length, 25 (24.4–25.6); zygomatic breadth, 15 (14.5–15.6).

Represented by 15 specimens (of which 3 are alcoholic), all taken at Medje, September 8, 1910.

Chærephon congicus is easily distinguished by its size, and dark coloration. The length of the forearm averages 56 mm. in a series of 12 adults, the skull 25, zygomatic breadth 15. It greatly exceeds the size of *C. angolensis,* from which it also differs in other important characters. The forearm in *angolensis* is given by Peters as 48 mm., and by Dobson as 47 mm., while the average in *congicus* is 55.8. It differs from *C. midas* in being smaller (forearm 55.8, in *midas* 60.4), with much smaller ears and much darker coloration.

63. **Mops niangaræ** sp. nov.

Type (and only specimen), No. 48901, ♂ ad. (skin and skull), Niangara, northeastern Belgian Congo, Dec. 12, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1313.

Similar to *M. congicus* but smaller and much paler.

Upperparts uniform cinnamon-rufous, extreme base of hairs much lighter; underparts tawny-brown, lighter and more yellowish on the pectoral area; ears, membranes and the broad naked space along sides of back and posterior margin of body dark brown; ears *not* joined at base, thick, and otherwise as in *M. congicus.* A large crown-patch of lengthened hairs, similar in color and texture to the surrounding pelage, but much longer, forms a broad, low crest covering the interaural portion of the head.

Collectors' measurements: Total length, 125 mm.; head and body, 91; tail, 34; foot, 13; ear, 22. Forearm (from skin), 52; third metacarpal, 52; foot, 13; ear from crown, 8.6; from notch at antitragus, 21; transverse breadth, 13.2; tragus very small, breadth at base and height about equal.

Skull, total length, 23.2; condylobasal length, 21.6; zygomatic breadth, 14.4; breadth of braincase, 11.1; interorbital breadth, 4.6; maxillar breadth, 9.8; breadth at base of canines, 7.1; upper toothrow (with canine), 8.2; length of mandible, 16; depth at condyle, 5.4; at coronoid, 4.5; lower toothrow, 9.4.

Mops niangaræ is structurally closely similar to *M. congicus,* but is smaller and much paler, and the ears are not joined by a membrane. The forearm is 4 mm. shorter and the cranial measurements are correspondingly less.

This is the only species of molossid bat in the present collection, numbering 19 species, in which the ears are not joined across the forehead by a strongly developed band, if we regard the high convex lappet between the ears, but not distinctly joined to them, in *Chærephon* (*Lophomops*) *abæ* as morphologically a connecting ear-band. In the present species (represented by the single type specimen) there is not even a vestigial band, but the position it should occupy if present is outlined by a line of slightly lengthened dark brown hairs, giving the visual effect of a vestigial band till it is carefully examined and found not to be a slight ridge of membrane.

64. **Mops trevori**[1] sp. nov.

Plate XLVIII, Fig. 2.

Type, No. 49250, ♀ ad. in alcohol, Faradje, Sept. 29, 1912; H. Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1954.

Pelage short, soft and fine, with the grayish sheen in certain lights seen in many other molossid bats.

Upperparts cinnamon brown, with the usual naked transverse zone across front of shoulders; underparts pale brown, darker on the sides and lighter medially, with the hairs of the pectoral region conspicuously tipped with grayish white; caudal end of body not denuded, but with the projecting bristly hairs seen in allied forms. Membranes and wing bones above blackish and naked, except for a small patch of short brown fur near the center of the propatagium; below much lighter and the wing bones whitish; naked portion of face and ears, and the naked hind limbs and tail blackish; interfemoral membrane above blackish, below much paler, as is also the ventral surface of the hind limbs. A low crest (the hairs about 5.5 mm. in length) arises from the back of the membrane connecting the ears and extends back over the front half of the interaural area and the basal half of the backs of the ears. The crest area is of the same color as the surrounding pelage.

Total length, 121.5 mm.; head and body, 82.3; tail, 39.2 (free portion 24); forearm, 53; third metacarpal, 53.5; thumb to base of pad, 8.4; tibia, 20; foot, 13.6; ear from notch, 20; breadth (near front border), 12; tragus minute, quadrate, 2 × 1.5; antitragus convex, broad at base and low, 6.5 × 4.

Skull, total length, 24.2; condylobasal length, 22; zygomatic breadth, 14.6; interorbital breadth, 5; mastoid breadth, 13.8; maxillar breadth, 10.4; breadth at base of canines, 7; upper toothrow (c–m^3), 8.6; length of mandible, 15.8; angle to condyle, 5.2; depth at coronoid, 4.5; lower toothrow, 9.7.

Represented only by the type.

Mops trevori is of nearly the same size as *M. congicus,* but it is slightly smaller in all measurements, except that the ears are larger. The coloration is radically different, the upperparts in *congicus* being deep chestnut, and dull cinnamon brown in *trevori,* with still greater difference in the color of the underparts. It differs from *M. midas* in much smaller size, while the color of both upperparts and the ventral surface in the two species is as different as between *trevori* and *congicus.* In cranial characters *trevori* is too different from either *congicus* or *midas* to render comparison necessary.

---

[1] Named for John B. Trevor, a Trustee of the American Museum of Natural History and Chairman of the Committee on African Exploration, whose enthusiasm and generosity in support of the Congo Expedition contributed greatly to its success.

Allomops subgen. nov.

Text Figs. 12–15.

Type, *Chærephon* (*Allomops*) *osborni* sp. nov.

Supraoccipital border of skull enormously developed in old males, the lambdoid crest high and broad, expanded upward and backward into an oblique overhang, equal in height to about one half the interorbital breadth of the skull, or considerably exceeding the width of the foramen magnum, the upper border nearly straight, equal in length to about one half the width of the braincase, with an extension downward from the lateral upper corner on either side to the mastoid process; less developed but strongly indicated in females and young males; sagittal crest weakly developed in the smaller species of the group, very heavily so in the larger forms.

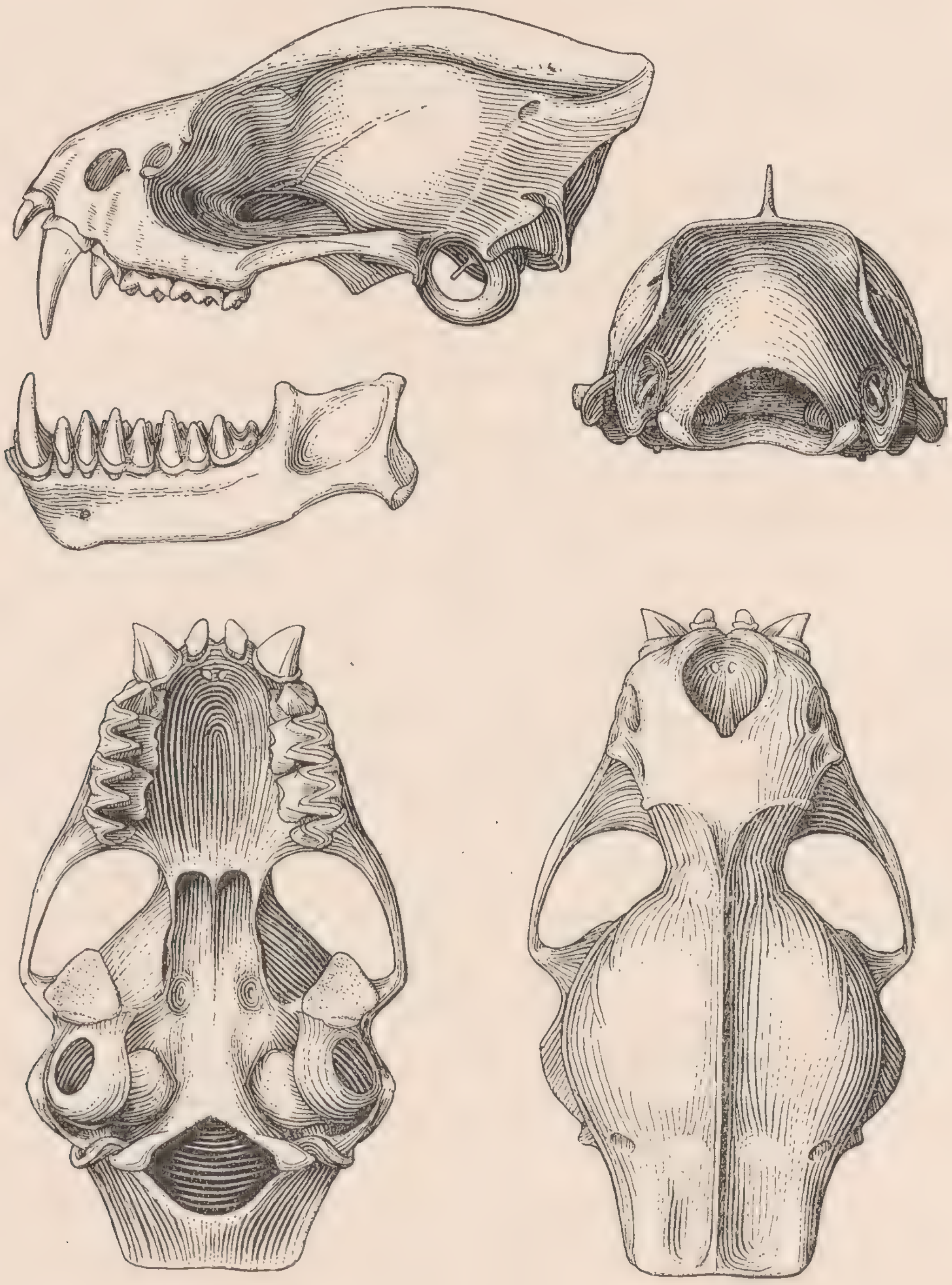


Fig. 12. *Mops* (*Allomops*) *osborni*. **Skull of type, adult male, No. 49230.** $\frac{2}{1}$.

General form of the skull as in *Nyctinomus*, the braincase broad and flattened, preorbital furrow or depression conspicuous, but preorbital processes absent; premaxillæ usually fully ossified on front border, but sometimes emarginate.

Dental formula: i $\frac{1-1}{2-2}$, c $\frac{1-1}{1-1}$, p $\frac{2-2}{2-2}$ (or $\frac{1-1}{2-2}$), p^2 being deciduous or wholly absent in some species), m $\frac{3-3}{3-3}$ = 30 (or 28). Upper incisors small, about one third the length of the canines, parallel, widely separated from each other and the canines;

lower incisors very small, bilobed, the outer smaller than the middle ones, postero-external to them in position, often one or both outer lower incisors deciduous. Upper canines very long, slender and sharp-pointed, with a broad, shallow longitudinal groove on the front face, and a narrow postero-internal cingulum; lower canines correspondingly slender, with a broad postero-internal cingulum. First upper premolar (p^2) minute, in the toothrow (usually) or external to the base of the canine, sometimes deciduous; p^4 about half the size of m^1, larger than m^3. First lower premolar (p$_2$) larger than p$_4$ in males, smaller than p$_4$ in females, the sexual difference in the size of p$_2$ well marked in all the (four) known species. Upper molars with m^3 small, about one third the size of m^2. Molar-premolar series in both jaws heavy, low and broad, with very broad mandibular rami.

Males larger than the females, the sexual difference in size especially evident in the skulls, where it is emphasized by the much larger size of p$_2$ in the males than in the females relatively to the size of p$_4$. Ears of medium size, thick and heavy, united at the base by a broad membrane, which extends forward as a conspicuous protuberance in front of the ears. Tail relatively short, about two fifths of the length of head and body, rather more than the apical half free. Sides of back naked, the naked space continuous with the naked hind limbs and naked hinder portion of the body, which is bare of fur on both surfaces posterior to a line joining the hips. From the region of the hips arises a fringe of scattered blackish bristles, directed backward and reaching to or beyond the middle of the uropatagium, the number of these bristly hairs varying, even in different individuals of the same species, from a few to a fairly conspicuous fringe. Pelage of the upperparts exceptionally short, soft and velvety; on the underparts longer and more dense. Color pattern distinctive,— very dark

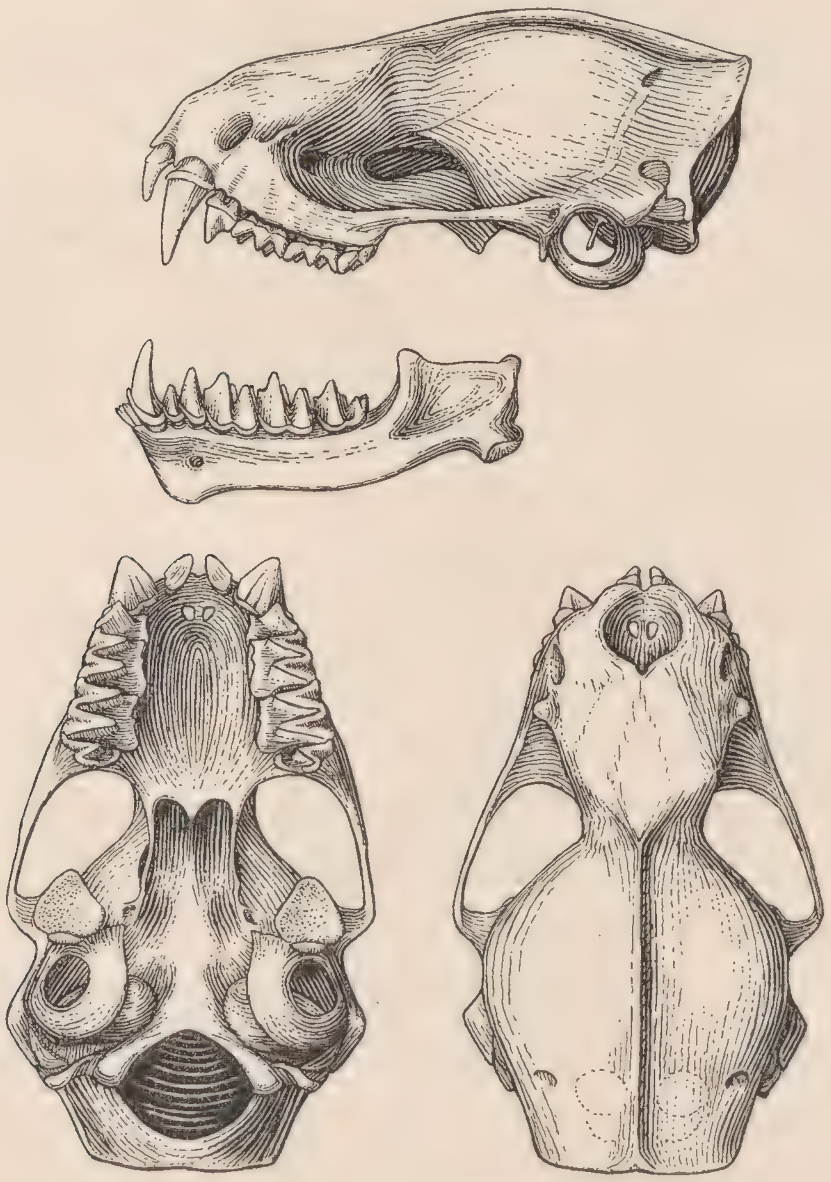


Fig. 13. *Mops (Allomops) osborni.* **Skull of adult female, No. 49244.** $\frac{2}{1}$.

above and along the sides of the body below, without white at the base of the patagium. Wing membranes blackish, thick and leathery.

The present group, whether considered as of generic or as only of subgeneric value, is a natural group, much more sharply defined from all others than is *Chærephon* from *Nyctinomus,* although these two groups have been long currently given recognition as genera. In the present connection it is given subgeneric rank. The four known species are here described as new, although one of them may be the same as *Nyctinomus thersites* of Thomas, which apparently belongs to the *Allomops* group. They are small to medium sized species, one of them, *Allomops nanulus,* being the smallest known African molossid.

In working out this group, in connection with other African molossid material, I have been impressed with the small value of the character most commonly considered as an important index to the relation of species referred to *Nyctinomus* and *Chærephon,* namely, the emargination or non-emargination of the front border of the premaxillæ. In one instance in the study of a series of 23 specimens collected the same day at the same locality, and evidently beyond question conspecific, I took up the skulls first, with skulls of other species, to determine their generic affinities. Later on collating the skulls (marked only with their catalogue numbers) with the skins to which they belonged, I found I had referred part to *Nyctinomus* and part to *Chærephon!* Further study of the same series showed that in this case at least emargination and non-emargination of the front border of the premaxillæ was largely dependent on the age of the specimen, the vacuity behind the incisors becoming gradually closed by ossification with the increased age of the specimen.

In one of the species here referred to *Allomops,* represented by six adult specimens, two, on the basis of the condition of the premaxillæ, are typically *Nyctinomus* and the other four typically *Chærephon.* They were otherwise indistinguishable, either on the basis of external and cranial characters or by the age of the specimen. In another species here referred to *Allomops,* represented by seven specimens, all of the skulls had the front palatal border emarginate, but as all of the other characters, both external and cranial, were typical of the *Allomops* group, it seemed proper to give preference to the combined weight of the *Allomops* characters, despite the *Nyctinomus*-like condition of the premaxillæ.[1]

---

[1] After writing the above I first became aware of Oldfield Thomas's paper, entitled 'On a remarkable new Free-tailed Bat from Southern Bombay' (Journ. Bombay Soc. Nat. Hist., XXII, pp. 87–91, April, 1912), in which he states that he had reached the same conclusion regarding the emargination or non-emargination of the front border of the premaxillæ in the Old World molossid bats. He says: "I may note also that all sorts of intergradations are found in the premaxillæ and that it is often almost impossible to decide whether a given specimen should be referred to one genus or the other [*Nyctinomus* or *Chærephon*] by this character of the premaxillæ."

65. **Mops (Allomops) osborni**[1] sp. nov.

Text Fig. 12–14, and 26.

Type, No. 49230, ♂ ad. (in alcohol), Kinshasa (near Leopoldville), Belgian Congo, Dec. 22, 1914; cotype, No. 94244, ♀ ad. (alcoholic), same locality and date. Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. of type, 2570.

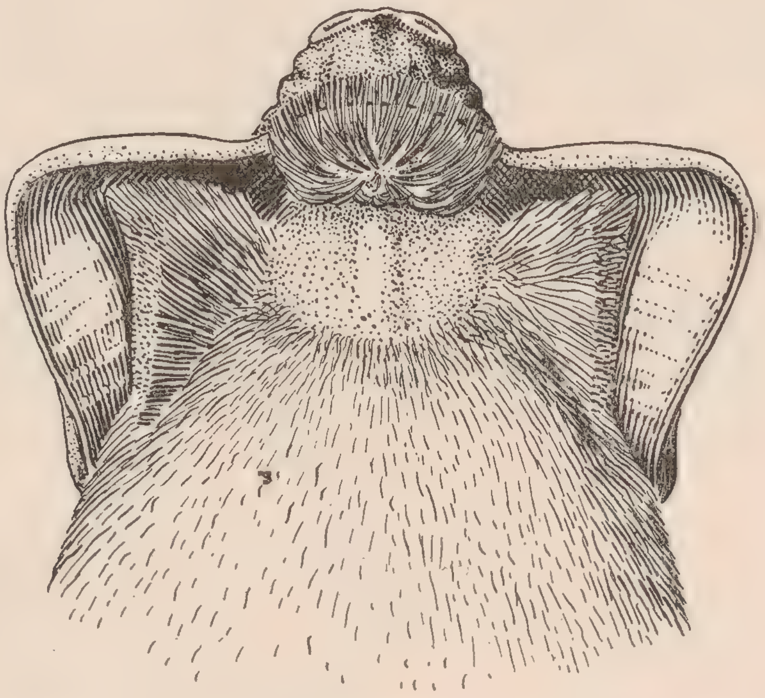


Fig. 14. *Mops* (*Allomops*) *osborni*. Crown of male type, to show the small crest on back of frontal membrane. $\frac{3}{2}$.

Upperparts dark hair-brown with a grayish sheen, the hairs whitish at extreme base; underparts, sides paler brown than back, the hairs grayish-tipped, the central area from chest posteriorly broadly white, throat and an indistinct pectoral band grayish brown; wing membranes and limb bones above dark brown, below lighter, becoming whitish toward the body, including the propatagium and a narrow posterior edging; uropatagium dark brown above, whitish below; ears united by a deep band, the back of the membrane (in both sexes) covered with lengthened hair-brown hairs which barely reach its upper border (Fig. 14). Tragus minute; antitragus small (about 4 × 4 mm.), evenly rounded above. Sides of back, lower back and hind limbs above naked and dark brown; under side of limbs and anal region naked and yellowish white. Face dark brown; upper lip heavily corrugated. No gular pouch in either sex. Feet heavily clothed with spoon hairs (see Fig. 26, p. 556).

Total length, male type, 111.3, female cotype, 106.6; head and body, 73.5, 70, tail, 37.8, 36.6; forearm, 49, 47; third metacarpal, 47.2, 46.5; tibia, 17.5, 16.5; foot 10.5, 10.2; ear from crown, 8.5, 9; length from notch at posterior base of antitragus, 14.7, 12.5; expanse (tip to tip), 33.8, 32.

Skull in the old-adult male type with a highly developed sagittal crest, as in *Molossus*, but differing from the latter in having also the lambdoid crest enormously developed, as in some other species of the *Mops* group. In the male type the sagittal crest has a height of 1.8 mm. and extends from the interorbital region to the lambdoid; in the female cotype neither the sagittal nor the lambdoid is more developed than in some species of *Nyctinomus* (*e. g.*, *N. ochraceus* and *N. leonis*). Rostral and interorbital regions broad (as in other species of the group), the braincase wide and rounded; premaxillæ fully ossified; palate deeply concave; basisphenoid pits small and shallow; p^2 vestigial, on the outer edge of the toothrow and difficult to see without the aid of a strong lens. The type has only one upper incisor, the right having been lost in life. (Figs. 12 and 13).

Measurements of type (male) and cotype (female) skulls: Total length, ♂ 22.9,

---

[1] Named in honor of Professor Henry Fairfield Osborn, President of the American Museum of Natural History, to whose unflagging interest and wise foresight in support of the Lang-Chapin Congo Expedition is largely due its monumental success.

♀ 20.7; condylobasal length, ♂ 19.6, ♀ 18.6; zygomatic breadth, ♂ 13.4, ♀ 12.6; mastoid breadth, ♂ 12.2, ♀ 11.8; breadth of braincase, ♂ 10.4, ♀ 9.9; interorbital breadth, ♂ 4.4, ♀ 4.5; breadth at base of canines, ♂ 6, ♀ 5.7; maxillar breadth (between outer borders of m^3), ♂ 9, ♀ 9.2; depth of braincase medially (without the crest), ♂ 7, ♀ 6.8; upper toothrow (including canine), ♂ 7.7, ♀ 7.2; length of mandible, ♂ 15, ♀ 13.3; angle to condyle, ♂ 5.2, ♀ 4; depth at coronoid, ♂ 4.2, ♀ 3.4; lower toothrow (including canine), ♂ 8.5, ♀ 8.1. Height of sagittal crest in male, 1.8, in female, 0.5.

Represented by 2 alcoholic specimens, type (♂) and cotype (♀), collected at Kinshasa, 6 miles from Leopoldville, lower Congo, December 22, 1914.

The only species with which the present form needs comparison is *Mops* (*Allomops*) *faradjius*, which differs from it in smaller size, less highly developed sagittal crest, less concave palate, and in certain other features indicated under *M.* (*Allomops*) *occipitalis.*

66. **Mops (Allomops) occipitalis** sp. nov.

Text Fig. 15.

?Nyctinomus thersites Thomas, Ann. and Mag. Nat. Hist. (7), XII, p. 364, Dec. 1903. Efulen, Cameroons.

Type, No. 48851, ad. ♂, skin and skull, Avakubi, Belgian Congo, Feb. 13, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2487.

Pelage short, soft and velvety, about 1.5 mm. in length on the back to about 2.5 on the sides of the neck, throat, and sides of body below. External base of ears and whole space between them thickly covered with slightly lengthened glandular black hairs, which also cover the back of the low connecting membrane, but do not rise much above it.

Fur of upperparts dark chocolate-brown; the sides of the back, the lower back from a line joining the hips posteriorly, and the hind limbs naked and blackish, the central furred portion of the back, from considerably in front of the shoulders to hips, of about the same width as the naked area each side. A scanty fringe of long bristly hairs (blackish or mixed with a few whitish ones) from the hips, directed backward, the longest reaching to or beyond the middle of the uropatagium (scanty or nearly wanting in some specimens). Underparts blackish laterally, the median area buffy brown; a ventral area (corresponding ventrally with that of the lower back) and limbs naked, pale rusty brown (the denuded space much reduced in some specimens). Ears near together, blackish brown, united by a low membrane which extends forward as a swollen obtuse projection reaching nearly half-way to the nose; front and upper border of ears thickened, forming a sharp angle at the anterior inner border; tragus merely a minute dusky point, about 2 mm. in height; antitragus brownish, small, about 4 × 4 mm., bluntly convex above. Face naked, blackish; nostrils prominent, upper lip weakly corrugated; chin naked, brownish. Wings from middle of tibia. Forearm and membranes naked. Wing membranes above, including antebrachium, blackish brown, lighter, grayish brown apically; below similar, the humerus and forearm whitish, in strong contrast with the membrane. Uropatagium dark brown and naked on both surfaces.

Collectors' measurements of type: Total length, 98; head and body, 68; tail, 30; foot, 11; ear, 18. Additional measurements from the skin: Forearm, 38; tibia, 15.5; foot, 10; ear from crown, 9; from notch behind antitragus, 16.

Collectors' measurements of 4 specimens (2 males, 2 females) from Medje (near type locality): Total length, 99.4 (98–101); head and body, 70 (68–73); tail, 29.2 (28–30); foot, 9.6 (8–11); ear, 18 (all 18). Forearm (from the skins), 38 (36–39).

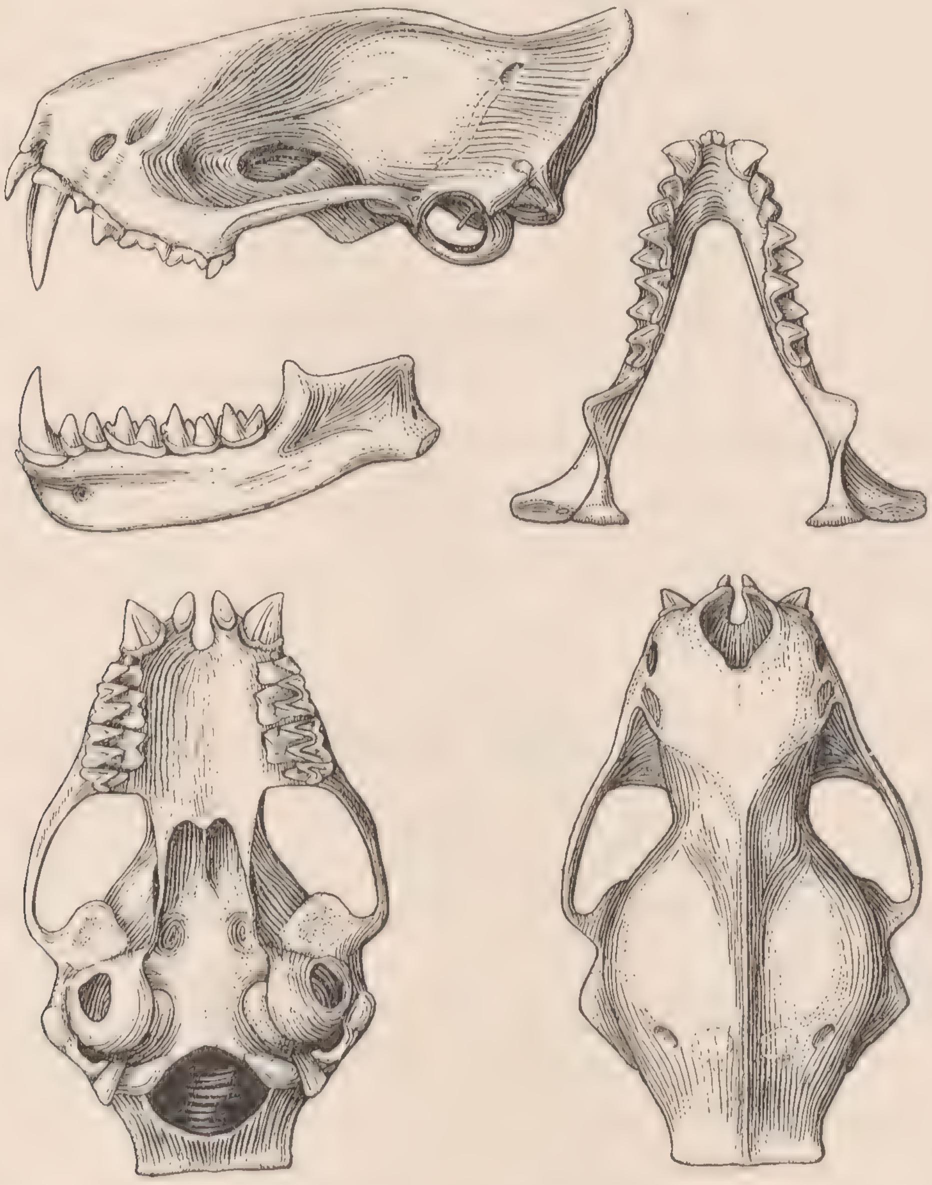


Fig. 15. ***Mops (Allomops) occipitalis.*** **Skull of adult male type (No. 48851).** $\frac{2}{1}$.

Measurements of the type skull: Total length, 20.4; condylobasal length, 18; zygomatic breadth, 12.7; mastoid breadth, 11.5; breadth of braincase, 9.5; interorbital breadth, 4.1; maxillar breadth, 8.2; breadth at canines, 5.8; depth (including pterygoids), 7.8; length of upper toothrow (c–m^3), 6.9; length of mandible, 13.4; angle to condyle, 4.5; depth at coronoid, 4; length of lower toothrow, 7.4 (Fig. 15).

Four skulls from Medje: Total length, 2 young adult males, each 91.8; 2 young adult females, 18.3, 18.8; zygomatic breadth (2 males, 1 female), all 12.5.

In the adult males the skull has the occipital region enormously developed, the lambdoid crest being high and broad with a marked backward overhang. In females and young males (subadult) it is much less developed. The mandible is noticeably massive in even young specimens.

Represented by the type, from Avakubi, and 6 specimens from Medje, of which 2 are about half grown and the others young adults, collected Sept. 15–16, 1910.

Judging from the description, *Nyctinomus thersites* Thomas greatly resembles the present species but whether they are identical cannot be satisfactorily determined without direct comparison of the types. The description of *thersites* makes no direct mention of the coloration of the underparts, which in *occipitalis* are very unlike the upperparts, the coloration of *thersites* being described as "Colour brownish chestnut, glandular hairs back of ears black." Other features mentioned point strongly to a form greatly resembling *occipitalis*. In *thersites* the premaxillæ are thus described: "Premaxillæ separated, but opening between them small," for which reason the species has been regarded as a *Nyctinomus*. In six skulls of *occipitalis* the premaxillæ are fully ossified in four of them and in the other two (one of them the type and the most mature specimen) there is a slight opening behind and between the incisors. In a skull of *A. faradjius* (the only one available for examination) the premaxillæ are fully ossified. In five adult skulls of the much smaller *A. nanulus* there is a very small opening at the inner base of the incisors in all, but in all other characters, external and cranial, including color pattern and femoral bristles, *nanulus* is obviously only the little brother of the three larger forms here referred to *Allomops*.

67. **Mops (Allomops) faradjius** sp. nov.

Type, No. 49222, ♂ ad. (in alcohol), Faradje, northeastern Belgian Congo, Nov. 1, 1913; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 3015.

Similar to *A. osborni* in general size and in coloration, but with a shorter forearm (44 instead of 49 mm.), a vestigial p^2 on the right side only, in the toothrow (visible only by aid of a strong lens), less developed sagittal and lambdoid crests (doubtless due to the fact that it is much younger than the type of *osborni*), darker upperparts and a more decided brownish band across the pectoral region.

Upperparts blackish brown, much darker than in *osborni;* underparts blackish brown along the sides and across the throat, forming a darker and broader pectoral band, the central area broadly whitish. Ears and membranes blackish, and in all other respects similar to those of *osborni*. The broad patch of glandular hairs between the ears deep black, fuller and longer than in *osborni* and covering the membrane connecting the ears, but not lengthened into a crest as in *Lophomops*.

Total length, 108 mm.; head and body, 76; tail, 32; forearm, 43.5; third metacarpal, 42.5; third finger, 82; ear from crown, 10; from notch behind antitragus, 17; expanse from tip to tip of both ears, 32.8; tibia, 15; foot, 9.

Skull, total length, 22.2; zygomatic breadth, 12.9; mastoid breadth, 11.5; breadth of braincase, 9.3; interorbital breadth, 4; maxillar breadth, 8.8; breadth at base of canines, 6.7; upper toothrow (c–m^3), 7.6; length of mandible, 14; angle to condyle, 4.5; depth at coronoid, 3.7; lower toothrow, 8.7; transverse extent of lambdoid crest at upper border, 6.7.

Represented by only the type, taken at Faradje, and labelled by the collectors as "from the stomach of a *Machærhamphus* hawk." The specimen (preserved in alcohol) is practically uninjured for study.

As noted above, *Mops* (*A.*) *faradjius* closely resembles *osborni*, but it has a much shorter forearm, a slenderer body, and, though a male, is somewhat smaller in both external and cranial measurements. It is also markedly darker in general coloration. The type localities of the two forms (Kinshasa and Faradje) are far apart and in regions of widely different environment.

68. **Mops** (**Allomops**) **nanulus** sp. nov.

Type, No. 48864, ♂ ad., skin and skull, Niangara, Belgian Congo, Dec. 12, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1318.

Similar in cranial characters and in dentition to *Mops* (*A.*) *occipitalis*, but much smaller and much lighter in coloration.

Upperparts cinnamon-brown; below with the whole median area lighter, the tips of the hairs dull gray with a slight yellowish or buffy tone, the sides much like the back but rather darker; extreme lower back naked or with only a slight pubescence; a thin fringe of bristly hairs from the posterior border of the dorsal pelage, the longer of these reaching to the base of the tail. Wing membranes from the sides of the back, light brown above, somewhat paler apically and on the lower surface. Interfemoral membrane palish brown above and below. Ears of medium size and thickness connected by a low membrane, from the back of which (most prominent in males) is a tuft of lengthened hairs, as in its larger congeners; inner base of ears heavily furred, and otherwise agreeing closely in form and structure with those of *occipitalis*. Tragus small, pointed, black. Antitragus of medium size, broad basally, convex on upper border. Tail short, rather more than the apical half free.

Skull and dentition similar to that of *A. occipitalis*.

Type, collectors' measurements: Total length, 82 mm.; head and body, 61; tail, 21; foot, 9; ear, 15. Forearm (from skin), 28.5. (The type is the largest of a series of 6 specimens.)

Type and 5 topotypes (3 males, 3 females), collectors' measurements: Males, total length, 78.7 (75–82), females, 76 (75–77); head and body, males 58 (56–61), females, 55.7 (54–58); tail, males, 20.3 (19–21), females, 20 (19–21); foot, males 8 (7–8), females 9 (all 9); ear, males 15.5 (15–17), females 17 (16–18). Forearm (from skin), males 28.6 (28.3–28.7), females, 27.4 (27.3–27.6).

Skull (type), total length, 16.8; condylobasal length, 15.5; zygomatic breadth, 10.9; mastoid breadth, 9.6; interorbital breadth, 3.3; maxillar breadth, 7.3; breadth at base of canines, 3; depth (including pterygoids), 5.7; upper toothrow (with canine), 6.1; length of mandible, 11.2; height, angle to condyle, 3.5; depth at coronoid, 2.9; length of toothrow, 6.8.

Skull, type and 5 topotypes (3 males, 3 females): males, total length, 16.5 (16.0–16.8), females 15.4 (15.3–15.6); zygomatic breadth, males 10.3 (10.5–11), females 9.9 (9.8–10). The females are thus smaller than the males, and they also lack the extreme development of the supraoccipital region shown by the males.

Represented by 7 specimens, all collected the same day at Niangara.

This species is readily distinguishable from all other known African molossid bats by its extremely small size, aside from any other characters.

Although the premaxillæ are slightly emarginate behind the incisors, the other characters, both external and cranial, agree completely with the larger forms here referred to *Allomops,* even in the sexual difference, and especially the sexual difference in the size of the lower premolar, p_2 being larger than p_4 in the males and smaller than p_4 in the females.

PART II. NOTES ON THE DISTRIBUTION AND ECOLOGY OF CENTRAL AFRICAN CHIROPTERA.

BY HERBERT LANG AND JAMES P. CHAPIN.

These notes are written with the desire of encouraging interest in the bats of equatorial Africa, so that those residing or traveling there may be enabled to recognize many of the species and make additions to their life-histories. Our results give a fair idea of how many forms may still be awaiting scientific description; and a glance at the literature shows, furthermore, that comparatively little is known about their habits.

Small bats need little preparation, since they can be placed in fairly strong alcohol, after having their abdomen opened; and, if the alcohol is changed before shipping, no fear of deterioration need be entertained. The preparation of skins as practised by mammalogists demands some experience.

Our work of collecting systematically started only after we reached Stanleyville, about 1200 miles inland. During five years of uninterrupted field-work in the northeastern section of the Belgian Congo, the gathering of larger mammals and birds formed the main object of the Congo Expedition. Therefore we could never devote as much time to the study of bats as we should have liked. We profited, however, by every opportunity to increase the scope of our collections and to gather data for a general zoölogical survey. Our efforts with regard to Chiroptera were well repaid, as shown by the list of species in the collection (*antea*, pp. 405–478).

Bats were collected in 27 localities, which of course include a hundred or more camps and villages within a radius of from 30 to 40 miles of each place. It may be interesting to state that out of the 68 species only 6 were gathered in areas where we spent little time or could not make special efforts. These localities are Cape Lopez, Boma, Malela, Thysville, Leopoldville and Kinshasa; all situated near the West Coast. Three of these forms — from Boma, Malela and Kinshasa — are described for the first time in this paper. All the other species — 62 out of the 68, with 29 newly discovered forms — are from only 12 localities (see pp. 410–413), extending from Stanleyville northeastward to Aba, a distance, as the crow flies, of not quite 450 miles. Since a few other bats have already been recorded from these regions, such an abundance of different forms across a fairly small territory reveals the ideal conditions offered to Chiroptera in Central Africa. (See Map, p. 415.)

Not only is the possession of flight an exceptional feature among Mammalia, but it has always been considered such an effective method of locomotion that zoögeographers excluded bats in drawing their conclusions.

Some species, like *Rhinolophus ferrum-equinum,* were formerly believed, even by scientists, to extend uniformly over Europe, Asia and Africa. Of late, however, they have been divided into numerous distinct forms, for in recent years the characters on which distinctions can be based have received more careful consideration. These facts should have a stimulating effect upon collecting, since it is certain that, just as in birds, there are many local species.

Exact information as to the number of species of Chiroptera from the Ethiopian region is not available, but in the whole world there are recognized at present, according to G. S. Miller (1907), "about 900 forms of Chiroptera, a number probably representing considerably less than half of what will eventually be known." Andersen's 'Catalogue of Chiroptera' enumerates 228 forms of fruit-bats, among which are 32 Ethiopian species (34 forms).

A few remarks about the distribution of fruit-bats after our long field experience in eastern and western Africa may clear up some of the intricate details of their range. More than two-thirds of all the fruit-bats known in the Ethiopian region, that is 25 forms, are recorded from the West African province ("Great West African Forest Tract, south to Damaraland, east to Victoria Nyanza,"[1] and north to the borders of the Sudan); and only ten species from the huge eastern and southern portion. Four of them (*Eidolon helvum, Roussettus ægyptiacus, Epomophorus gambianus, Epomophorus anurus*) overlap with those of the West African province. Two species occur only in southern Arabia and one only on the Island of Pemba. The latter is a representative of the genus *Pteropus,* elsewhere unknown in the Ethiopian region. It tends to show, together with Malagasy fruit-bats and other island forms, the isolating influence of the sea, to which the species occurring on the islands off the West Coast do not submit, for all the fruit-bats of Fernando Po, St. Thomas, and Annobon belong to the same forms as those of the neighboring mainland.

A review of the principal physiographic features involved will probably offer the best explanation of their distribution. The West African rainforests extend from the shores of the Gulf of Guinea, with a slight interruption near the Gold Coast, eastward to the foot of the Ruwenzori, over a distance of 3000 miles, and form at places a sector more than 400 miles wide (see map, p. 415). The relative absence of important mountains, the generally slight elevation, the typically moist equatorial climate with little or no well-marked seasonal change, are factors that have facilitated the even dispersal of flora and fauna to such a degree that uniformity, one might almost say monotony, has become the hall-mark of this great forested complex. In later years botanists have confirmed the view that in spite of its luxuriant diversity of forms the flora of this rain-forest in its general composition is fundamentally the same over its entire extent. Many of its important elements are even represented far beyond its confines, in the wooded extensions along the larger affluents of the rivers draining the territory.

---

[1] Andersen, Knud. Catalogue of the Chiroptera. Vol. I. Megachiroptera. London, 1912. p. lxvii.

As shown previously, fruit-bats are naturally more common in regions covered by rain-forest, where fruit ripens throughout the year, than in more arid regions, where such fruit-bearing trees as furnish food for these bats are rarer and one crop of fruit is the rule. These latter regions have well-marked rainy and dry seasons. Fruit is naturally scarcest after the annual fires have slowly eaten across the country and left the shrubs and trees leafless and the fields in such a barren condition that a comparison with the effects of heavy frosts in temperate climates suggests itself. Within a very short time the grass sprouts again and flowers often cover the trees before the leaves have appeared. It is of great importance that only a few degrees north of the equator the seasons happen to be the reverse of what they are at that time south of the equator. Furthermore the essential elements of the flora remain nearly the same over the entire eastern and southern Ethiopian sub-regions. Thus the fruit-bats of these districts, by adjusting their migratory flights, might easily escape the unpleasant and otherwise inevitable conditions of an annual famine. In fact the power of flight could bring them within the fragrance of ripening fruit throughout the year, if they but chose to travel across country between 5° south and 5° north of the equator. Such migrations are wholly within the powers of fruit-bats. Since fruits are not always equally plentiful, they have to shift continually even in the rain-forest. They have nowhere well established roosts, nor are they present in numbers for a long period in any region except where cultivation of non-autochthonous fruit-trees helps provide an ample food-supply throughout the year, as in many eastern and western coastal districts. Though no positive observations with regard to regular migrations are on record and only "large flights" and "great numbers," without date or locality, are found in the descriptions of various travelers, the occurrence of several species (*Eidolon helvum, Roussettus leachi, Roussettus œgyptiacus, Epomophorus wahlbergi, Epomophorus anurus*) across the eastern and southern portion of the Ethiopian subregion would be a good reason to suggest migration as the only possible solution of their presence throughout the entire territory, where they would have to starve should they remain in one region throughout the year.

The following detailed notes on the species collected by the Congo

Expedition prove that the range of many of these fruit-bats extends, as might be expected, across the entire West African province. Of the larger and more gregarious forms, that for many reasons can be more easily observed, we know with certainty that they are found not only across the rain-forest but far beyond into the drier regions in many of the larger forested galleries. The range of several of the small and rarer forms known only from a few localities was considerably enlarged by our observations and will undoubtedly be still more extended as the knowledge of African bats increases through the more detailed results of further explorations.

Fruit-bats of course reach much larger dimensions, and their body is relatively heavier, than is the case with insectivorous bats. But size alone offers no real point of distinction, as is shown by a comparison of the measurements of the largest and smallest African bats of each group.

Fruit-bats	*Total length*	*Wing-spread*
Hammer-headed bat (*Hypsignathus monstrosus*), male	10.25 inches	3 feet 2 inches
Pygmy fruit-bat (*Megaloglossus woermanni*)	2.75 inches	10.25 inches
Insectivorous bats		
Black hawk-bat (*Saccolaimus peli*), female	6.1 inches	2 feet 3 inches
Mouse pipistrelle (*Pipistrellus musciculus*), female	2.5 inches	6.5 inches

The Malay flying-fox (*Pteropus edulis*), measuring one foot in length and 5 feet across its fully expanded wings, holds the record for size among the Chiroptera.

Dull shades of brown generally predominate in the fur of African fruit-bats and help to render them inconspicuous when at rest. To distinguish them at once from their insectivorous compatriots, two external characteristics give ready clues.

1. The form of the ear (Fig. 1, *B*, p. 407), with its borders coming together below, differs from that of insectivorous bats, where a space intervenes between the lower edges of the anterior and posterior margins (Fig. 1, *A*, p. 407).
2. The second digit, forming the edge of the wing, bears a terminal claw (Plate XLIV, Fig. 1), not present in any insectivorous bat.

The thumb is long and well developed, bearing a claw as in all other bats, but here sufficiently strong to sustain their weight when climbing about on the branches. It is also used, together with the foot, to help hold the fruit when feeding, thus really functioning as a finger. The claw on the second digit considerably increases the use of the wing as a hand. The third finger is always the longest, the fourth and fifth the shortest. In *Eidolon helvum*, which has the widest distribution and is also the greatest traveler among African fruit-bats, the third digit is especially long and the fifth rather short, thus forming a long and narrow wing, much better suited for its long flights. In epomophorine bats, however, the fourth and fifth digits nearly equal the third; the resulting broad wing intimates, as we have often observed, that their flight is more irregular. A rather heavy wing adapted for relatively slow flight is characteristic of all fruit-bats; the membranes are never transparent, but usually dark,— brown or almost black,— yellowish only in *Casinycteris*. These membranes are very extensible. They are folded around the body not only as a protection against the rain but also, when hanging on leafless branches by the hundreds (*Eidolon helvum*), to shield the eyes against the glaring sun.

The tail is either much reduced or totally missing, and instead of a continuous caudal membrane we find only rudimentary borders along the inner side of the legs. Thus they are devoid of any such efficient steering apparatus as that which a long tail supporting a large membrane would offer, and have only their long legs to rely upon for turning. With them flight is only a means of travel from tree to tree to secure fruit and is not needed for the rapid and eager pursuit of fast-flying prey, so great a necessity to all insectivorous bats. The comparative simplicity of the outer ear, and the lack of highly developed sense organs in their wing-membranes are noteworthy facts. Contrary to the behavior of insectivorous bats the larger fruit-bats, when let loose in a room, fly against obstacles and windows with the same injurious effects as birds.

Sexual characteristics are, as a rule, more pronounced in fruit than in insectivorous bats. The larger size of the males (p. 502), the huge ossified larynx (pp. 501 and 505), and the glandular patches of conspicuously colored hair (p. 512), will be mentioned in the notes under the various species.

Since fruit forms their only food, it is hardly possible that their eyes alone, though relatively large, should suffice to discover it, especially as much of the wild fruit is hidden beneath the dense canopies of the larger trees. Their great flights, resembling migrations, have been pointed out under notes on the various species and are undoubtedly undertaken in search of ripe fruit. From our observations we feel sure that their sense of smell is very highly developed and our experiments show that it is probably their principal guide, since the fragrance of ripe fruits is often very strong. In nearly all fruit-bats the nasal region is extremely long, with well-developed ethmoids as a special provision for the highly sensitive organs of smell. The large olfactory lobes (Fig. 20, p. 507) also show that smell with them is a very important factor.

The skull with very few exceptions (p. 511) is elongate and rather smooth in outline. The brain-cavity is comparatively small, a certain sluggishness in temper and action distinguishing them from the more active insectivorous bats. The mandible with its long, interrupted tooth-row is slender and weak, and is operated by rather poorly developed jaw muscles. The canines are fairly long, rather dull, and often round in transverse section, fit for wrenching off, cutting open the fruits, or holding them in the mouth during flight. Their cheek-teeth, with crowns often narrow, are rather degenerate and are chiefly of assistance in separating the pulp from the fiber, as in mangoes, or in squeezing out juices from the pulp. Their food requires little or no mastication.

The very extensible tongue is beset above with gustatory and tactual papillæ. The latter are often arranged in a patch near the tip, tridentate and stiff enough to serve as a rasp (Fig. 16), helpful in gathering pulp and juices from inside the fruits after their outer cover has been torn. In some species juices of fruits are also sucked by means of extensive pouches underneath the lips (Fig. 18, p. 503).

The digestion must be extremely rapid (p. 499) and the quantities of fruit or their juices consumed large, hence the great patches of apparently fresh pulp, together with the remnants of spoiled fruit, underneath boughs that seem to be used as habitual dining-halls (pp. 501 and 504).

The destruction they cause may be considerable; but by transporting these fruits, sometimes to a distance of several hundred yards, before feeding upon them, they naturally distribute their seeds. These sprout readily and grow into trees under the favorable influence of the moist climate. Valuable fruit-trees are planted in this way beyond the confines of the cultivated area of the posts. Since the larger species (*Hypsignathus monstrosus*, *Eidolon helvum*, and *Epomophorus franqueti*) habitually move fruits as large as figs or guavas in fairly great quantities we can easily imagine what an important rôle fruit-bats play in the propagation of certain fruit-bearing trees throughout the West African rain-forest. It may even surpass any similar agencies of monkeys and birds that usually receive all the credit in this line. *Eidolon helvum* with its flocks of thousands dropping into a country in search of ripe fruit should certainly be an effective factor for the dissemination of many forms, such as wild figs (*Ficus*).

In the West African province they cause no devastation whatsoever to native plantations, since the negroes there plant not a single indigenous fruit-tree. Palm-nuts are not attacked, in fact the tastes of these fruit-bats coincide somewhat with those of the human race. Sweetish, acidulated, or juicy pulp are their chief aim, and therefore the fruits of trees imported by Arabs or white men are especially liable to be attacked. It is true that they are very fond of plantains and bananas, but these are cut when in a green state and are then absolutely unpalatable to fruit-bats. Only after they have ripened underneath the roof of native huts are they stolen by these tiny gourmets.

The insectivorous bats in this collection, represented by 60 forms as against 8 of fruit-bats, give a fair idea of their relative predominance, since both kinds were collected under equally favorable circumstances. From the number of species described we have reason to think that the same proportion, which we found between fruit and insectivorous bats in the northeastern section of the Congo basin, holds good for the entire West African sub-region. We might thus account for about 180 species of insectivorous habit in contrast with only 25 of fruit-bats within the same boundaries. Extending the same ratio still further, some 250 species of Microchiroptera may be found to inhabit the entire Ethiopian region; this is considerably more than are recognized at present.

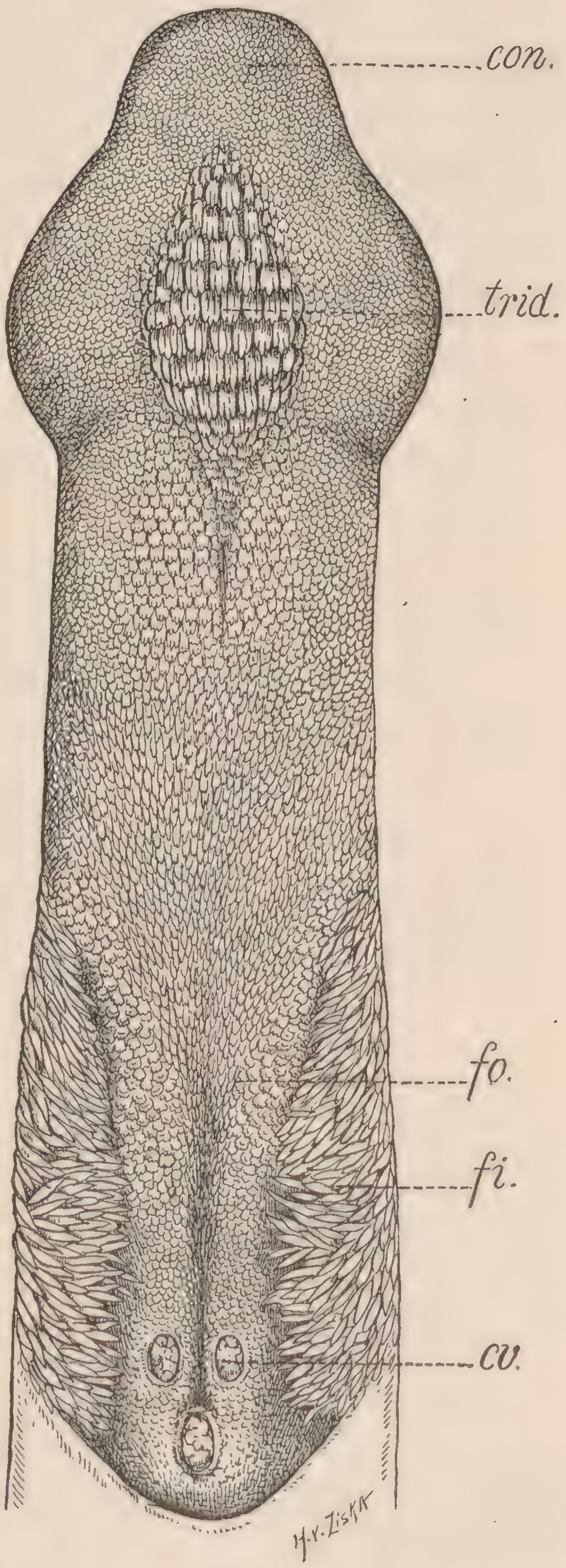


Fig. 16. *Hypsignathus monstrosus.* Tongue of adult male (No. 48657), from above. $\frac{2}{1}$. It shows the form, when extended, characteristic in life. *con.*, conical; *cv.*, circumvallate; *fi.*, filiform; *fo.*, foliaceous; *trid.*, tridentate papillæ.

Yet in spite of their variety the insectivorous bats of the Ethiopian region do not show as wide a differentiation as those of the Neotropical region. There is not a single blood-sucking form (Desmodontidæ) in Africa, though the large herds of game might be cited as offering opportunities for such feeding habits. Although there is not a single fruit-bat (Pteropodidæ) in the Neotropical region in spite of the large number of fruits in its equatorial forests, nevertheless one family of the Microchiroptera, the Phyllostomidæ, has developed several fruit-eating genera. South America also has fishing bats (Noctilionidæ), though positive evidence of bats feeding on vertebrates has yet to be offered for Africa. Pechuel Loesche records from Damaraland (South West Africa), having "found repeatedly in places (caves), where bats slept, fresh remains of small lizards, birds, and even Chiroptera."

Though far richer in species, these insectivorous bats were never such a noticeable feature of the crepuscular landscape as the larger fruit-bats. The latter really command attention by their great flights continuing for weeks at a time across country. Their noisy voices cannot be compared with the faint squeaks of even a dozen hawk-bats (*Saccolaimus peli*) though they may appear regularly on the village square. Hardly anybody pays attention to the few little bats (*Hipposideros, Nycteris, Rhinolophus*) that occasionally enter lighted rooms. By infesting double-roofed houses or uninhabited rooms, they make themselves a nuisance, since the smell of their excrement soon becomes unbearable in the moist atmosphere. When emerging from their dusky places of refuge, they scatter over the landscape so that even on clear, moonlight nights one seldom sees more than 20 or 30 hunting, each one separately. They never appear in such numbers as feeding flocks of swallows, swifts or bee-eaters, even near places where their colonies are large.

The families of African insectivorous bats have no great preference for either rain-forest or bushveldt. All of them, except the Megadermidæ and Rhinopomidæ, furnish an almost equal number to both zones. The species are perfectly endemic to either, just as distinct at least as birds of the forest and birds of the plains. The kinds of insects these bats feed upon in either area are perhaps the decisive factor that makes them stay in their respective environments. With this in view the species contained in the present collection may be classified as follows:

			Habitat chiefly	
		in forest	*in bushveldt*	*in both*
Emballonuridæ	4 species	1	2	1
Nycteridæ	5 "	2	2	1
Megadermidæ	1 "	—	1	—
Rhinolophidæ	9 "	3	5	1
Vespertilionidæ	22 "	10	11	1
Molossidæ	19 "	9	10	—

The following 24 forms are characteristic of the rain-forest. Some are still found as far as fifty miles beyond its confines in the more extensive forest galleries.

Emballonuridæ
  Saccolaimus peli

Nycteridæ
  Nycteris avakubia
  " arge

Rhinolophidæ
  Hipposideros caffer niapu
  " langi

Vespertilionidæ
  Myotis bocagii cupreolus
  Pipistrellus musciculus
  Scotozous rüppelii
  Eptesicus tenuipinnis
  " minutus minutus
  Mimetillus moloneyi
  Pachyotus nigrita nux
  Glauconycteris humeralis

Glauconycteris alboguttatus
Kerivoula cuprosa
Molossidæ
Myopterus albatus (?)
Nyctinomus leonis
" ochraceus
Chærephon russatus
Nyctinomus aloysii-sabaudiae (?)
Mops congicus
" niangaræ
" occipitalis
" nanulus

Bats living in the open country or bushveldt, like certain birds from the plains (Bishop-birds, etc.), are also found occasionally within the borders of the forest where extensive human settlements have entirely altered conditions. The following 32 forms, however, were collected only in the bushveldt.

Emballonuridæ
Taphozous sudani
Coleura gallarum nilosa
Nycteridæ
Nycteris pallida
" major
Megadermidæ
Lavia frons affinis
Rhinolophidæ
Rhinolophus hildebrandti eloquens
" abæ
" axillaris
Hipposideros abæ
" nanus
" gigas niangaræ
Vespertilionidæ
Myotis bocagii bocagii
" " hildegardeæ
Pipistrellus abaensis
Eptesicus ater
" faradjius
" garambæ
Scoteinus schlieffeni
Pachyotus altilis
Glauconycteris papilio
Miniopterus breyeri vicinior
" inflatus
Molossidæ
Nyctinomus ansorgei
" cisturus
" frater
Chærephon (Lophomops) chapini
" " cristatus
" " abæ
Mops midas
" trevori
" (Allomops) osborni
" " faradjius

Furthermore there are five species that have a much wider distribution than those mentioned previously. They are at home in the rain-forest as well as in the open country because they follow closely in the wake of man and live either in the native plantations (*Pipistrellus nanus, Myotis bocagii*) or in and about human dwellings (*Taphozous mauritianus, Nycteris hispida, Hipposideros caffer*).

The distribution of insectivorous bats is greatly influenced by the fact that most of them have definite roosting-places. They are not typical vagabonds, like the fruit-bats, wandering about the country for the sake of a meal. On the contrary, their food-supply is so abundant everywhere and at all times that good places of refuge are apparently the only requisite for the establishment of their colonies. In these regions, wherever one sees hills, with suitable clefts or caves, or big hollow trees, one is practically sure to find insectivorous bats; but on the level and barren plains, one is just as sure to find very few. They sometimes shun trees or other places infested by ants, the winged individuals of which they readily devour, and yet they inhabit trees housing termites, which seem not to molest them. Far from minding the company of flying-squirrels (*Anomalurus* and *Idiurus*) or of geckoes (*Hemidactylus*), they are often found living with these.

Those with gregarious tendencies have so many traits in common that one looks in vain for differences in their behavior caused by diversity of environment. On the borders of the dry regions of the Sudan or in the moisture-laden rain-forest their habits seem in all essentials the same. They may flock together, sometimes only half a dozen in a small knot-hole, or several hundred in a large hollow tree or rocky cleft. Caves may attract thousands but all these colonies are made up habitually of members of but one species. Night after night they return to their accustomed roosts, which they do not abandon even when frequent raids made upon them by the natives have thinned out their numbers. Large, juicy lumps of fat, deposited in and about their abdominal cavity, stimulate the natives to kill all they can.

Native traditions, and still more the thick layers of guano in some of the caves and beneath the rocky clefts, would tend to justify the belief that many of them die where they are born. This is fully confirmed by the records of *Rhinopoma microphyllum* living by the thousands in the Pyramids. Anderson (Zoology of Egypt, Mammalia, 1902, p. 148) offers proof of their having lived and bred there for nearly 3000 years without showing any perceptible changes.

The species of Molossidæ which we found have a relatively limited range. Among them gregariousness is the ideal mode of life and they huddle together in lumps. Often they exhale a disagreeable odor that might possibly help them to find each other more easily. Our observations would tend to show that they probably are polygamous, although data from other countries indicate that males and females of this family form separate colonies, at least at certain seasons. The Emballonuridæ show stronger propensities for society than the Rhinolophidæ. Of the Vespertilionidæ only a few species form really large colonies. Houses and similar structures which offer the same advantages as their natural abodes are readily invaded by such bats.

All these bats that live in colonies and rest with feet and wings against the walls (p. 549) and climb over each other, have short smooth appressed, rather lustrous hair. With all the Molossidæ, at least, we find this to be true. Among the Emballonuridæ, *Saccolaimus peli* and also *Taphozous mauritianus* are good examples, though they rest singly. Even *Eidolon* *helvum*, the only fruit-bat we found hanging up in clusters, has short, somewhat glossy hair different from our other fruit-bats.

These features seem so important a characteristic that one can set apart nearly all the other bats that have loose, rather long and sometimes frizzled hair. These hang perpendicularly, suspended by only the claws of their hind limbs, each one by itself. Sometimes they live in hollow trees and form colonies (*Hipposideros langi*) but never huddle together in bunches. Caves or houses may shelter them in great numbers (*Hipposideros abæ*, *Hipposideros caffer*). Others hang one by one on branchlets (*Lavia frons affinis*) or hide in dense clusters of leaves (*Eptesicus faradjius*, *Glauconycteris papilio*), or rest in the vegetation of swamps beneath the crown of papyrus (*Nycteris pallida*). One would include in the long-haired groups also such solitary bats as *Kerivoula cuprosa* and *Pipistrellus musciculus*, that crawl into knot-holes, and those that seek refuge in bunches of plantains (*Pipistrellus nanus*, *Myotis bocagii*).

A few remarks on certain conditions in these territories which especially influence the food-supply of insectivorous bats will probably add to the better understanding of their life-histories.

The equatorial rain-forests with their moist, even temperature of about 100°, changing as little in the lapse of 24 hours as during a twelvemonth, offer conditions to them that could hardly be more favorable. Neither the bats nor the insects upon which they feed have there to submit to such inhibitory influences as would be caused by hibernation or estivation. The great humidity also prevents such catastrophes as the spreading of fires.

The forested galleries are like promontories pushed far out into the drier regions, where annual grass-fires have stunted the growth to such an extent that the large hollow trees in these moist tracts or along the rivers represent the only opportunities for roosting. The vicinity of water, especially the open sheets with their abundance of crepuscular insect-life, are undoubtedly an invaluable adjunct. These forested belts also act as an effective barrier against the destructiveness of the grass-fires and, being the only luxuriant places amidst the scorched fields, they become a haven of refuge for millions of insects.

The open country or bushveldt, with grass growing to a height of 5 to 14 feet, has 15 to 25 percent of its surface covered with bushes and low trees; usually not attaining more than 30 feet in height. A few still larger ones are scattered widely between. Shortly after the end of the rainy season, in December and January (in the northeastern Congo basin), the impeding and now useless minor vegetation is set on fire as an annual house-cleaning.

To insectivorous bats such extensive grass-fires mean wholesale destruction of their food-supply. Millions of insects are then wiped out. Small forms, trying to escape as the crackling of exploding grass-stalks comes nearer, are carried high up into the air by the heat-waves. Here they are preyed upon even by the bats, which in the Uele district are often attracted to the fires in the night, just like swifts, swallows and other birds during the day. But most of these insects are carried far away and alight undoubtedly along the areas not destroyed by the flames. During this conflagration bats are more plentiful in the neighborhood of rivers and such species as formerly sought protection in the clusters of green leaves are suddenly forced to look for other hiding places. At Faradje on the Dungu River, when the trees were leafless, we observed that some bats not seen before about human settlements came to the houses (*Eptesicus faradjius* and *Glauconycteris papilio*). Even *Lavia frons affinis* which keeps to the open plains throughout the year was more numerous in the trees about the post, and *Taphozous mauritianus* likewise increased in numbers.

Travellers that happen to camp, during this season, away from streams and surrounded by the blackened soil might look in vain for bats. Shall we wonder that *Lavia frons,* the species most ubiquitous over the equatorial bushveldt, has learned to care little for cover and often hunts in bright sunlight? Is it surprising that it feeds upon Coleoptera so large, that it seizes them one by one? In its habitat tender insects that could be gathered in rapid flight by the dozens may become scarce at times.

Since their crepuscular and nocturnal habits of feeding have so vitally influenced their structure, it is not without importance to state that, as a rule, only those insects which disport themselves in full flight during at least a few hours of darkness can make up their bill-of-fare. If we think of the nuptial flights of termites, so abundant as to form a staple food even for natives, of the clouds of mosquitos, of the numbers of roaches, crickets and moths we realize that the supply exceeds the demand. From examinations of their stomachs, we know that, besides Isoptera, Diptera, Orthoptera and Lepidoptera, many Hymenoptera, Hemiptera, and especially Coleoptera, furnish a very large share of their sustenance.

The food of each species consists undoubtedly of a great variety of insects, a selection influenced probably by their seasonal abundance. In the bushveldt their sudden appearance in great numbers is a very noticeable feature. They seem to come and go with the growing and perishing of the minor elements of vegetation, following well marked seasons. Yet in the seasonless rain-forest such cycles of great profusion seem equally common.

A few bats may gather at least a part of their food, such as small roaches and spiders, in clambering about fruits and between the leaves. Of this we suspect especially *Pipistrellus nanus,* which would be greatly helped therein by its crawling propensities (p. 530).

As we might expect from such highly specialized forms, insectivorous bats at times display abilities which place them among the most successful predatory types. Their brain-case is comparatively large, and their skull shows a greater diversity in form than that of any other suborder of the Mammalia. It clearly demonstrates how feeding-habits and the food to be masticated or digested completely change the shape of the skull, the dentition and, in some cases, even the digestive organs (Phyllostomidæ, Desmodontidæ). Among the bats of the Ethiopian region we cannot point out equally striking differences, but two skulls illustrated in this paper show the point in question. The heavy skull of *Mops* (*Allomops*) *osborni* (Fig. 12, p. 470), with an enormous sagittal and lambdoid crest, is capable of giving strong support to large muscles of mastication. They are needed to operate the broad grinding, cutting surfaces of the short dental rows. The food of all such Molossidæ consists chiefly of hard-shelled insects. On the other hand the globose, smooth skull of *Kerivoula cuprosa* (Fig. 8, p. 452) offers support for only small muscles. The rostrum is strongly pinched together. The teeth are narrower, and the tooth-rows and palate longer. Their food consists of tiny mosquitos and similar insects.

The great width of their gape (p. 531) assists them in feeding rapidly, for many of these insects disappear as quickly as they come. This wide-open mouth acts as a net and every insect entering is instantly put to death by the sharp dagger-like canines. The short tooth-row serves as an exceptionally efficient milling apparatus. They literally cut and grind their prey to dust with a few bites, an exceptional advantage when we consider that speedy digestion is thereby made possible. For only by pulverizing or separating their food in this manner are the muscles of these minute and often hard-shelled insects instantly exposed to the digestive fluids. Bats, having no crop like a bird in which to store away their food, thus succeed in extracting all there is in the food in the quickest possible manner. We observed *Hipposideros gigas niagaræ* feeding on termites so ravenously that, after filling its stomach, it tucked into its cheeks all they could hold. It also had its mouth full when shot.

The wings show considerable variety and are either narrow and pointed, as in those that fly as swiftly as swallows, or are broad and rounded, as in those that flutter about apparently in the aimless fashion of butterflies. They all have a short, clawed thumb (p. 549) and four greatly elongated fingers which "serve like masts that keep the canvas of a sail spread and regulate its motions," as Goldsmith picturesquely writes.

Besides serving as mere supports during flight, the wing and interfemoral membrane have another very important function. Together with the large nose-leaves and curiously modified ears of certain species, they act as highly sensitized organs. They seem to feel and in reality must be able to measure certain waves, so that it appears as if they could see and hear with them as well. The experiments of Spallanzani have shown that even if blinded they will not strike in flight against any solid object except when thoroughly exhausted. When chasing them in closed rooms, we often have seen them escape in full flight and apparently unhampered by narrow slits in the windows and doors through which we thought they could hardly crawl. Dobson believed that long-eared or leaf-nosed bats prefer darkness, but the Megadermidæ, with the largest nose-leaves and ears, are semi-diurnal; the Nycteridæ, with these appendages still fairly elaborate, we found to be rather crepuscular. Yet *Taphozous* with no nose-leaves at all, generally hung in relatively light places throughout the day, and was one of the last to fly out. Their behavior depends evidently on feeding-habits or on the abundance of their victims at such hours.

At Faradje where *Taphozous mauritianus* was common we found great numbers of moth-wings beneath places where they were accustomed to rest. These evidently were habitually rejected before feeding.

The interfemoral membrane, really their third sail (p. 516), is well developed in all African families of Microchiroptera, except in the Rhinopomidæ. It undoubtedly increases the steering facilities which, by stretching out or pulling in the limbs or shifting the tail, play such an important part in the capture of insects, all of which have their own peculiarities of flight. The full stomach of bats shot on the wing furnish evidence that their erratic flight cannot be entirely ascribed to their inability to progress with ease. On the contrary, we are prompted to look upon their meanderings as an exhibition of great dexterity where flight of any kind is but the means to a successful end. Entomologists, who will remember how often they looked longingly after an insect that they endeavored to capture in full flight, are probably the most qualified and willing to assent to such a statement.

Secondary sexual differences amongst insectivorous bats are far more varied than in fruit-bats. They are however much less conspicuous and depend mostly on specific characteristics. Under these circumstances we find it best to refer to the field notes, where we have pointed out all those that came to our attention. These are:

1, the larger gular pouches of the males of *Taphozous mauritianus* (p. 513);

2, the larger size of females of *Saccolaimus peli* (p. 515);

3, the dorsal glands in males of *Lavia frons affinis* (p. 520);

4, the possession of a frontal sac and abdominal appendages in *Hipposideros caffer* (p. 524);

5, the curious anal sacs of *Hipposideros langi* (p. 526);

6, a crest, sometimes larger in females, as in *Chærephon frater*, or present only in males as in *Chærephon* (*Lophomops*) *abæ* (pp. 547 and 553);

7, the higher sagittal crest of the skull in some males, as of *Mops* (*Allomops*) *osborni* (p. 470);

As a rule, all the Chiroptera have one young, but from several records we conclude that two may occur occasionally in all species. Most bats in these regions breed throughout the year, but a definite breeding season may exist in such gregarious forms as *Eidolon helvum* (p. 497) and *Nyctinomus ochraceus* (p. 546) and perhaps in most of the Molossidæ.

Besides man the rather rare bat-hawk, *Machærhamphus anderssoni*, is their most important enemy (Plate LV). Fast flier that it is, bats still know how to dodge it. It cannot pounce upon them successfully except when high above the dense canopies of the forest or over wide expanses of water.

Appendix A.— Native Beliefs and Interest in Bats.

Since, in making these collections, we profited much by the information gathered from natives, it may be well to state a few of their beliefs. With their fondness for generalizations they consider all bats birds though they readily distinguish two categories: the larger fruit-eating kinds that bite like a dog and the smaller insectivorous bats that fly about like swallows and have needles in their mouth.

The lack of meat-producing herds of cattle, with dogs and chickens only as a meagre substitute, and with cannibalism practically abolished, have helped to develop in these Congolese negroes an interest in the haunts of bats. They are still a more satisfactory animal food than grasshoppers or caterpillars. The smaller species inhabiting hollow trees, rocky clefts or caves on account of their large number are as welcome as the larger fruit-bats. The native says the former live in villages but if he finds fruit-bats hanging together in clusters (*Eidolon helvum*) he believes they assemble so as not to get wet from the daily rain, and is quite amused that the younger ones, having to hang outside, complain and scold continually. The negro also knows that fruit-bats hear well when asleep, for he has observed that they move their head, no matter how cautiously approached. They seem to be unable to discover the native who, shooting a few with an arrow, considers all of them blind during the day.

Though hardly any species is rejected as too small, the Molossidæ, forming large colonies, contribute much to the fame of bats as delicacies. These natives consider disagreeable odor an advantage and fat flatters their palate. Spiked on a splinter of wood, singed and broiled over the fire, the bowels left in as a condiment but pressed out just before serving make them choice morsels. Meat and bones are crunched with delight. The canines of insectivorous bats, of which the natives speak as needles, are removed with great care for, according to general belief, they would pierce the stomach, with sure death as a result. Among the Mangbetu the fat, wrinkle-lipped bats (Molossidæ) are often brought to the king as a special delicacy. Roasted and arrayed in rows of five and ten on a rod, they make a very welcome present, but should one forget to break out their needles he would be guilty of the gravest offense. Suspected of an intention to murder the king, his days would be numbered.

APPENDIX B.— EXTERNAL CHARACTERS OF THE FAMILIES OCCURRING IN THE ETHIOPIAN REGION.

The Rhinopomidæ, with one species inhabiting Egypt, are not represented in our collection, but we wish to give the chief external characteristics of all the 7 families of Microchiroptera known from the Ethiopian region. *Rhinopoma*, the only genus, is easily distinguished from all other bats by its slender tail (Fig. 17, *A*), nearly as long as head and body together and greatly surpassing the very small interfemoral membrane, and by the presence of two phalanges in the index-finger.

The Emballonuridæ are represented by only a few species. The hair of the body may frequently be short and appressed but never very long. The muzzle is slightly elongate, the nostrils simple, the eyes relatively large, and the ears erect with small rounded tragus (Plate XLIX). The legs are slender, the wings curiously folded when at rest (Fig. 21), the wing-membranes either dark or translucent. The tail always projects above the large interfemoral membrane (Fig. 17, *B*), it fits so loosely in the wrinkled skin that it can often be withdrawn (p. 515). They are extremely fast fliers and can turn with exceptional ease.

The Nycteridæ are a small family. The body is covered with rather long, loose fur, the nose-leaves conceal a frontal pit, the lower lip has a warty tip, the ears are large with a small tragus, the eyes small (Fig. 3, p. 426). The long tail supports the large uropatagium and terminates in a Y-shaped tip (Fig. 17, *C*). The wings are broad.

The Megadermidæ are known from only a few forms. We refer to the notes on *Lavia frons affinis* (p. 520) and also to Fig. 22 and Plate L. The large nose-leaves with long bifid tragus, and the shortness or lack of a tail are the chief characteristics of this family. Their semi-diurnal habits are especially noteworthy.

The Rhinolophidæ are a large family. The body is covered with relatively long hair, that sometimes appears frizzled; a Y-shaped, short-haired area on the back is typical of some forms. Horseshoe-like, complicated nose-leaves (Plate LI and Plate LII, Fig. 1) are especially characteristic. The large ears are without a tragus, the moderately long caudal membrane is supported to the very tip of the tail. Their flight is rather spasmodic, but swift. They feed on a great variety of insects.

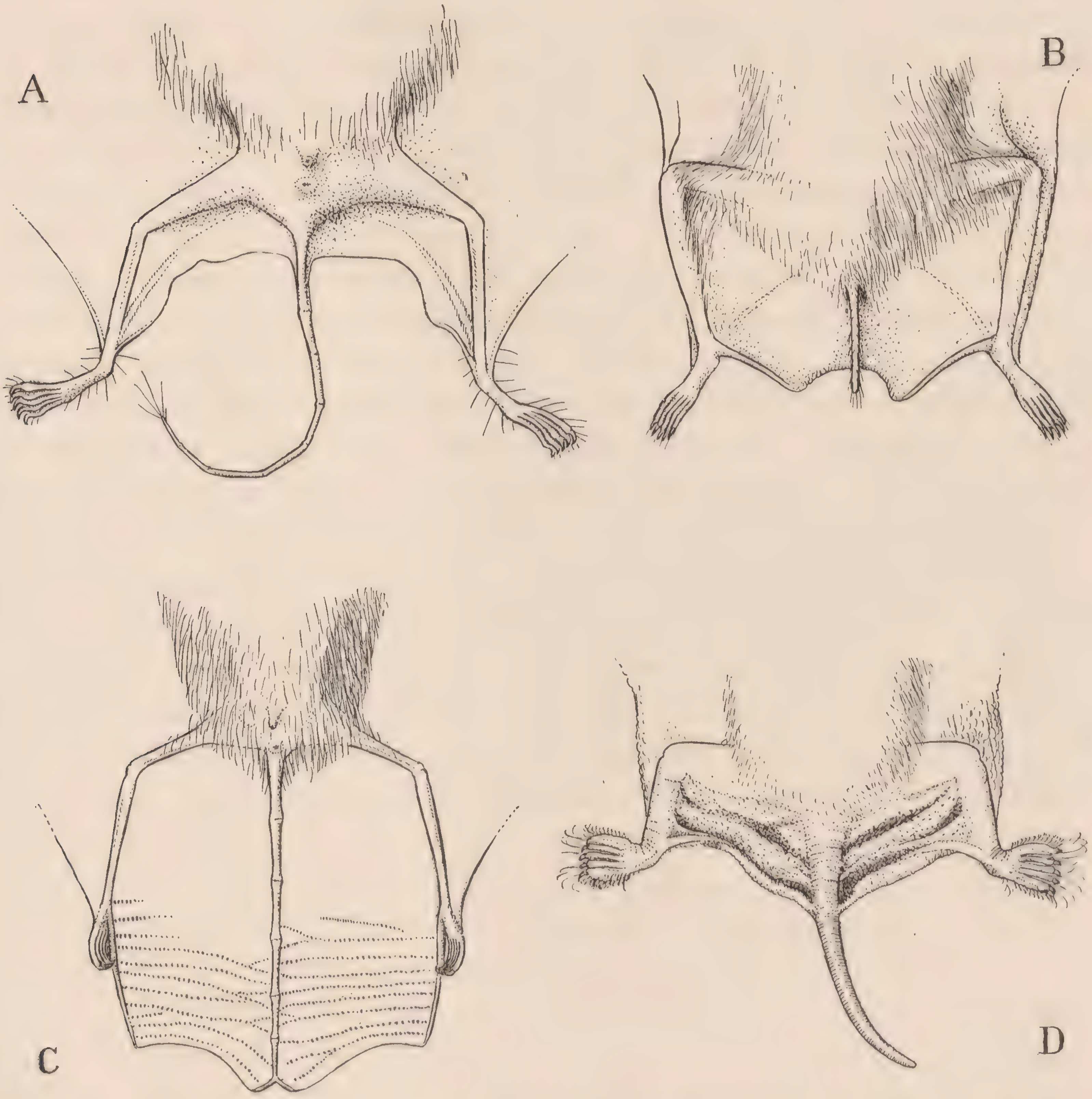


Fig. 17. Interfemoral membranes: *A*. Rhimopomidæ (*Rhinopoma microphyllum*), from beneath; *B*. Emballonuridæ (*Taphozous mauritianus*), from above; *C*. Nycteridæ (*Nycteris arge*), from below; *D*. Molossidæ (*Nyctinomus ansorgei*), from above. All $\frac{3}{4}$. For interfemoral membrane of Megadermidæ, see Fig. 22 (p. 537); of Rhinolophidæ, Figs. 5 and 6 (pp. 436, 437); of Vespertilionidæ, Figs. 7 (p. 448) and 22 (p. 537).

The Vespertilionidæ represent the largest group and comprise the ordinary bats of temperate climates. This family consists mostly of small forms, with loose fur, a short head, small nostrils terminating in an obtuse muzzle, no nose-leaves, relatively small eyes and ears, the latter placed on the side of the head, with slender, nearly straight tragus. The wings are fairly broad, with two phalanges in the middle finger. The color of their membranes may be either dark, transparent, or even vividly colored. The interfemoral membrane is especially wide and supported to its very tip by the tail-vertebræ. Most of them feed on very small insects, and some, like *Pipistrellus,* take mosquitos. *Mimetillus,* having short appressed hair and narrow wings like the Molossidæ, is to be noted as an exception (Fig. 22).

The Molossidæ are rather common. They have short appressed body-hair with a peculiar velvet-like luster in life. The head is rather thick and clumsy, the muzzle obliquely truncate, the small nostrils usually terminate in a pad, but without nose-leaves. The ears may be erect and separated (Plate LIII, Fig. 2) but more often join across the forehead and project beyond the tiny eyes (Plate LIII, Fig. 2). Their posterior borders extend far down on the cheeks and the tragus is small. The wings are very narrow, their tips folding underneath (Fig. 25) or above, the membranes dark, light or transparent. Typical of this family is a separate narrow band of fur near the inner edge of the wing-membrane on its lower surface, extending from the armpit to the thigh and usually of the same color as the belly. The tail projects considerably beyond the edge of the interfemoral membrane, its skin thick, fitting loosely over the vertebræ (Fig. 17, *D*). The heavy, short feet are free from the membranes; but the spoon-hairs on the two outer toes are characteristic (Fig. 26); those on the wrinkled lips are often very minute. Their flight is extremely swift and rather continuous, with turns less rapid than the Emballonuridæ. They generally feed on hard-shelled insects.

PART III. FIELD NOTES.

By Herbert Lang and James P. Chapin.

MEGACHIROPTERA.

Pteropodidæ.

1. **Eidolon helvum** (*Kerr*).[1]

Plate XLIV, Fig. 3.

The color of this large fruit-bat when adult is a distinctive dirty yellowish brown with deeper orange tawny hair on the glandular skin on the front of the neck, especially in males. The small free tail is decidedly variable in length, from .25 to .80 of an inch (6 to 20 mm.). In contrast to the epomophorine bats it has a more pointed head, like that of the flying-foxes; the wings are long and narrowed, and spread about 30 inches (755 mm.) though the length from nose to tip of tail is but 8 inches (200 mm.). They are much used in climbing about the boughs on which they roost, and their tips are then folded in precisely the same manner as in the vespertilionid genus *Miniopterus* (see Fig. 24, p. 541), the second phalanges of the third and fourth digits being turned inward so as to lie flat on the lower surface of the wing. Perhaps *Eidolon* is thus better able to search about for fruit. *Hypsignathus* and the epaulet-bats, on the other hand, have more difficulty in approaching and detaching them; they are not active climbers, and can bend these joints but little inward, using the tips of the wings more often to cover the belly as they hang upside down (see Plate XLVII).

Among flocks of *Eidolon helvum* the immature members are always numerous, as could be ascertained by looking over the large numbers killed by natives at their roosts. In November at Avakubi, out of 12 females, the five really adult were gravid, four having one fœtus and the fifth two. This would indicate the existence of a definite breeding season, although the testes of an old male taken at Avakubi in May (No. 48706) were unusually well-developed, measuring 24 mm. in length. The fur of the front of its neck was moistened with a sticky fluid (not greasy) possessing a slight musky odor, apparently secreted by the skin beneath. At all seasons these bats have a disagreeable smell.

---

[1] The notation of the species in this list is the same as that of Part I, the numbers prefixed to the names of the species in either list serving as a cross-reference to the same species in the other.

At Avakubi, November 19, 1909, a flock of perhaps 100 had taken shelter for the day beneath the limb of a large tree, some 60 feet above the ground, where they were shaded by a mass of epiphytic ferns and orchids, and formed one great squirming mass. Ever and again one seemed to lose its hold in the crowd, took wing, and hooked itself up anew. All the while they kept up a chorus of snarling and scolding noises that could be heard a hundred yards away. This led to their discovery.

After watching their amusing struggles for a while, we fired both barrels of a gun into their midst. We were standing almost directly beneath, and for a few seconds it simply rained bats, dead or wounded. The latter immediately began to make off through the grass, but were hunted down by the blacks, who picked them up with caution, for they scratched and bit savagely, often uttering a harsh nasal cry. Thirty-seven specimens were secured. Of the survivors, only about a dozen returned to the same branch, the others seeking refuge somewhere else, for all these fruit-bats fly well during daylight.

A flock passing over the Ile Berthe near Stanleyville on the evening of August 2, 1909, was estimated, as we watched them for a quarter of an hour, to number from 1000 to 1500. They flew in a westerly direction.

From August, 1913, to September, 1914, Chapin remained in the region about Avakubi and took a special interest in the seasonal vagrancies of these bats. He not only kept a very careful watch during his customary strolls but also collected many bats to verify his observations, of which the following is a summary.

Until early September (9th) none were noticed, but from that time on for about three weeks hundreds went flying over almost every evening, traveling in a southwesterly direction.

No more were observed until early in May, 1914, when many of them began to come flying across the Ituri River and over the post, from the northwest. Though they would pass at only 20 yards above the fruit trees that were being plundered just then by *Hypsignathus,* they evinced no interest in the guavas. During the rest of May and until about June 10, they passed regularly in large numbers in a southwesterly direction. After that they seemed to have established themselves in the region, for they were seen flapping about in more aimless fashion and alighting in trees. On June 5 a restless flock of 20 were found during the afternoon in a rubber tree. When approached they climbed about in their usual noisy and nervous manner, using the claws of both wings and feet, but finally took wing.

Though they were apparently resident at Avakubi in July, migratory flights towards the southeast took place again on the 2d and 4th. In August they had disappeared once more.

At Medje from May 10 to early June, 1914, Lang observed them flying every evening in an easterly to southeasterly direction, though in June the later arrivals gathered in the trees just before nightfall. Dozens of them were killed every day by the natives with arrows and nooses.

Certain small islands in the Aruwimi near Panga are famous in that region for the number of these bats that they harbor at certain seasons. We were told when passing in September that they always come at low water (February and March).

At Stanleyville a few were seen again in October, 1914, and great numbers at Sierra Leone in February, 1915.

At Leopoldville they are brought to market tied together in large bunches, dead and alive. We saw this in December, and in April Rodhain and Bequaert procured live individuals for their study of the dipterous parasites (Nycteribiidæ), with which *Eidolon helvum* is habitually infested. The remarks of these authors on the habits of these bats in captivity[1] are worthy of repetition. "We have fed these animals almost wholly on sweet bananas, of which they consume considerable quantities, but which pass through the digestive tube with great rapidity. These bats seem hardly to assimilate anything but the directly soluble juices contained in fully ripened fruit, for the substance of the fruit itself is passed out by the anus practically unchanged."

During the two and a half years we were in the Upper Uele district, beyond the northeastern edge of the forest, we never observed *Eidolon helvum*, but found *Epomophorus anurus* common at Faradje, and *Epomops franqueti* was still heard in the forest galleries as far north as Yakuluku.

Schubotz found large colonies of *Eidolon helvum* in September on the islands of Lake Kivu, but there are no records apparently of its occurrence in British East Africa, though its range is usually given as extending across tropical Africa from Khartum on the north to Namaqualand in the south. This roussette is very gregarious and within its range the most abundant of its family, but its occurrence in large numbers is decidedly irregular. No observing traveller can fail to notice their immense flocks as they pass by the thousands just after sunset, especially in the neighborhood of open water. Their flight is then fairly rapid. In fact they can actually sail with rigid wings, descending at times slightly in their direct undulating progress, seldom making a low guttural sound. Those who have had an opportunity to see thousands of these bats defile every evening in the same direction high in the air have no doubt as to their performing a migration, especially since at first none of them seem to alight. Only later they suddenly appear to have made themselves at home. This becomes apparent at once, since hundreds of them are then slain by the natives, who are fond of eating these bats.

---

[1] Bull. Soc. Zool. de France, XL, 1916, p. 250.

We are not able to coördinate our present observations and the published records from various regions so as to show beyond a doubt that large migrations take place at definite seasons. Such movements might be necessary to find new fields of food supply, though throughout the equatorial forests fruits seem to be available during the whole year. Unfortunately we could not ascertain what fruits they really prefer, as the stomachs of dead specimens were always found to be empty. The reason for this is explained by the experiments of Rodhain and Bequaert. It is nevertheless certain that immense numbers of *Eidolon helvum* journey about irregularly and then become abundant in regions from which they were previously absent.

2. **Epomops franqueti franqueti** (*Tomes*).

Plate XLIV, Fig. 2; Plate XLV.

This is a typical epaulet-bat; the adult males have a peculiar glandular sac lined with long white or yellowish hair on each shoulder, always very conspicuous in dried specimens. But in the live bat this pocket may be so drawn in as to conceal the "epaulet" almost completely. Its dull brown pelage is often tinged with purplish, especially on its darker ventral side, which bears a conspicuous whitish patch on the abdomen. They have no tail. The thin lips are muscular and distensible, well adapted for sucking fruit.

The adult males are somewhat larger than the females and reach 7 inches (178 m.) in length with a wing-spread of 23.62 inches (600 mm.). They appear to give birth to but one young which, in one case, though two-thirds the size of its mother, was still clinging to her breast and was carried about during flight. The breeding season probably extends throughout the year since we have recorded young during every month in which we collected these bats — from October to May.

No traveller visiting the Congo forests can fail to hear the peculiar note of *Epomops franqueti franqueti*. The loud roar of the tree-hyrax (*Dendrohyrax*) and the short, tirelessly reiterated whistle of this bat are by far the most typical nocturnal sounds. Throughout the year in the neighborhood of almost every village in the Ituri region, and far beyond the forest area, wherever there are propitious wooded places, its vocal efforts ring intermittently through the stillness of the night — practically from sunset to sunrise.

Strange to say, experience taught us that very few Europeans knew that they were listening to a bat, since this high-pitched musical sound with its continuous effort seems to be emitted rather by a bird than a mammal. Standing on the deck of a steamer that had tied up for the night at one of the islands in midstream below Bumba, we heard them for the first time, and for our part were greatly perplexed. Finally we felt content to ascribe these strange sounds to some night bird, especially as the natives and white men of long experience in the Congo confirmed our belief. Questioning the natives is to little purpose, for they consider bats to be birds, and will simply reply that it is a bird of the night and eats fruit.

The voice of *Epomops franqueti franqueti* is more nasal than that of *Hypsignathus* and when heard at short range might be written *kŭrnk!* or *kyŭrnk!*, but at a distance it has a whistled effect, almost musical, being repeated slowly with intervals of $\frac{3}{4}$ to 1 second, and often for many minutes without a break. Only the adult males, as in *Hypsignathus*, have a large ossified larynx and they alone produce this weird, curious call. Though several of them may be heard simultaneously, these bats are hardly gregarious and when calling are usually far apart. They are very shy, and become silent at once when approached. More often they fly off quietly, recommencing their solo at some distance.

During the daytime when frightened from their retreats in the dense undergrowth of the forest, only one or two are usually seen at a time. This fruit-bat often visited the post at Avakubi to steal guavas, frequently carrying them, before eating, to a more suitable perch, sometimes into mango-trees or even out to an island in the Ituri River, about 200 yards away. Traces of their meal — parts of the seed-filled pulp, or half-eaten fruits — could often be seen in such places lying about the ground. Wild figs were likewise eaten but the presence of these bats near villages has probably much to do with their liking for ripe bananas, which they often find in neglected gardens. Undoubtedly they are keen of scent, for they come without fail to bunches of mellow bananas fastened beneath an overhanging roof where they could not possibly be discovered by sight. The peculiar strong fragrance of this fruit offers the only explanation of their success in this respect. At Avakubi, Medje, and Niapu they regularly fed on our bananas, pulling down many more than they ate. In a native village near Niapu several of them came together. One night a female was caught by the wing in a rat-trap set purposely. She made a hoarse snarling noise, flapping about desperately; but the others, so wary otherwise, did not mind this in the least and kept on feeding. Two of them were taken in lighted rooms, evidently attracted by the ripened fruit in the house.

We have observed this species everywhere in the Ituri district, as far east as Penge, and also at Niapu and Poko in the Uele. They were still common at Niangara and Vankerckhovenville, and one specimen was taken in the lower Congo at Leopoldville. We have heard them along the rivers wherever suitable forest is abundant, as far northward as Aba, Yakuluku and near Bafuka. They range from southern Nigeria and Angola eastward to Lake Victoria.

3. **Hypsignathus monstrosus** *H. Allen.*

Plate XLIV, Fig. 4; Text Figs. 2 (p. 419), (p. 485), 18, 19, 20.

The hammer-headed bat with its strangely truncate head is much better pictured by its scientific name, which refers to the enormously swollen nasal region of old males, the monstrously developed pendulous lips, the grotesque ruffles around the nose, the warty snout, and the hairless split chin (Text Fig. 2).

In adult males, which are much larger than the females, the cheek-pouches are extraordinarily developed, extending beneath the entire face anterior to the eyes. All this skin, as well as the upper lips, hangs loose. Only about the nostrils is it firmly attached, but the pouches of the two sides are completely separated by a thin, elastic median partition along the broad ridge of the rostrum, where the skin is much thickened and provided with numerous fibers of striated muscle. Beneath it two tube-like prolongations of the cheek-pouches run back close along the mid-line to between the ears, where the short hair on the top of the face ends. The lower lips are only attached to the inferior border of the rami and are free as far back as the last molar. In the region of the symphysis their muscular attachment is especially peculiar (Text Fig. 18).

In general color *H. monstrosus* is nearly uniform grayish-brown, with a slightly paler abdominal patch, a lighter grayish band across the breast, and a white tuft of hair near the base of the ear. This is by far the largest fruit-bat found in Africa, with a wing-spread of 3 feet 2 inches (967 mm.) and a total length of 10.25 inches (260 mm.). They bear only one young, as shown by dissections of several females, each of which had a single fœtus, in May and December. We therefore assume that they reproduce throughout the year.

When hanging at rest they fold their wings so as to form a rain-proof cover over the breast and belly. During the day we observed them, either singly or in small groups, in the denser foliage high up in the trees, or even in the undergrowth. Near the bank of the Nepoko River at Bafwabaka, in May, 15 of them were discovered some 60 feet from the ground, so close together that 6 were brought down by a single discharge of the gun, only one of them an adult male. On the other hand, near Avakubi, a lone bat was disturbed during the day in the undergrowth, and flapped out close beside us.

Throughout February and March, 1914, a number of these huge noisy bats used to gather in the trees along the forested bank of the Ituri River a couple of miles above Avakubi, where we camped and observed their habits closely. Every evening, shortly after sunset — about 6.15, to be exact — some 30 of them would be seen crossing the stream to the south bank, not in a flock but singly, in straggling fashion. Entering the trees on the far shore, they would start at once to call. Each individual gave a loud *pwŏk!* or *kwŏk!*, repeated at short intervals, say of $\frac{1}{3}$ to $\frac{1}{2}$ of a second, though occasionally several notes would be emitted in very rapid succession.

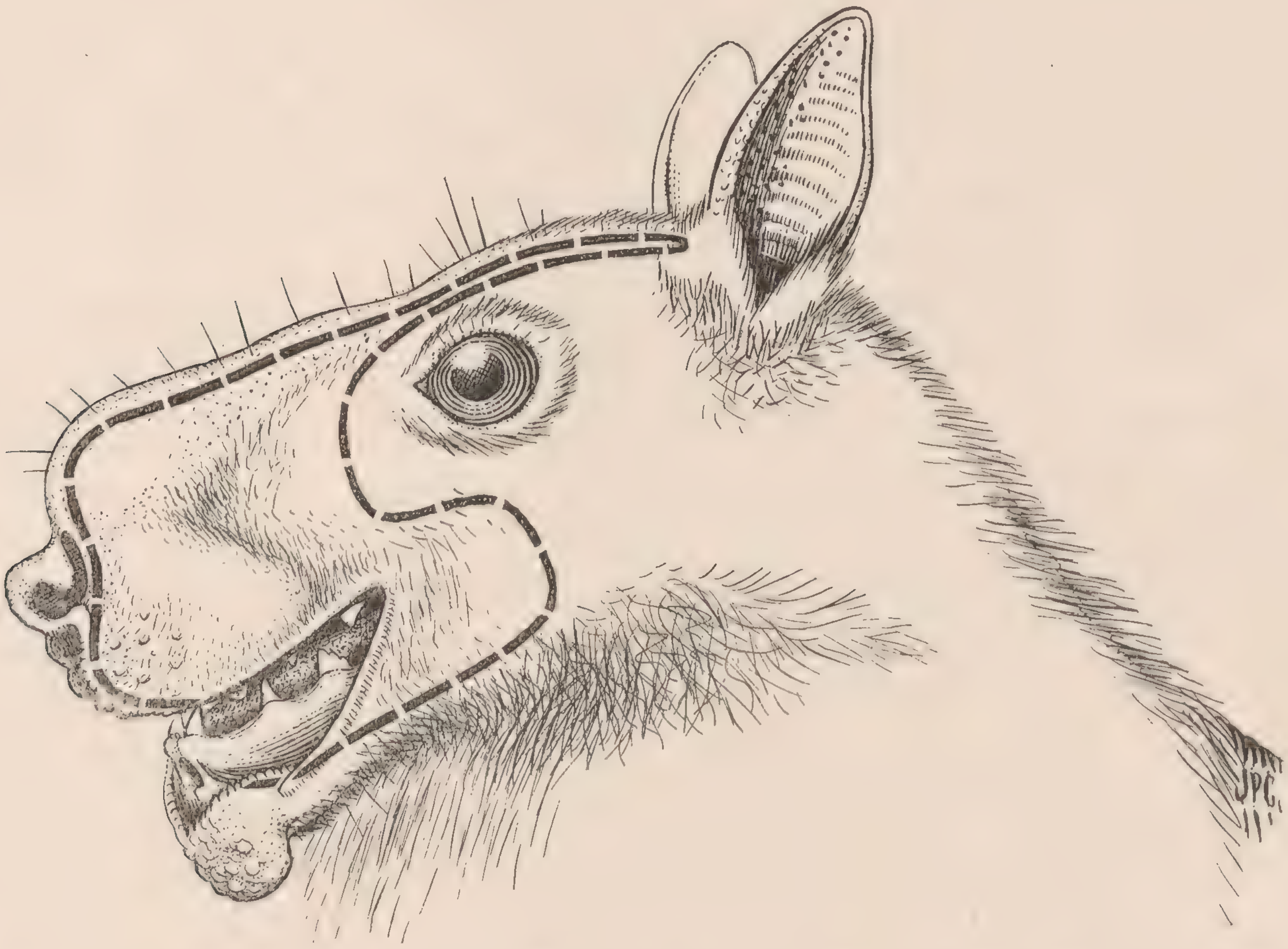


Fig. 18. *Hypsignathus monstrosus.* Head of adult male (No. 48657). The heavy broken line indicates extent of cheek-pouch. $\frac{3}{4}$.

This noise would continue without serious interruption till 10 or 11 o'clock, to be taken up again at intervals later on, but ceasing entirely by half an hour before daylight. We never saw them recross the river.

During this performance their utter lack of fear was amazing. Neither talking, rapping on the trees, lighting a lantern, nor even firing a gun could induce them to cease their calling. Their chorus made us think of a pondful of noisy American wood-frogs, greatly magnified and transported to the tree-tops.

At this particular spot only adult males assembled, as was shown by the nine specimens shot as they crossed the river; before darkness set in they had all arrived. Yet they did not seem to come in search of food. Large rat-traps baited with guavas were fastened in the trees they visited, but none was touched.

Just before they began to cross the stream, every evening, we could hear the whole chorus far back in the forest, where they evidently spent the day with their females and young. An overcast sky would delay their arrival 10 or 15 minutes, and rain would practically silence them. Although wounded females have been heard to produce a harsh noise, the old males alone call in this loud fashion. Their enormous ossified larynx is responsible for their very loud voice. The males of *Epomops franqueti*, which likewise call strenuously, also show an enlargement of this organ, whereas the females of both species have it more moderately developed. In *Epomophorus anurus* and *Eidolon helvum*, on the other hand, species which are comparatively silent, the larynx is of normal size.

We observed the hammer-headed bat in the northeastern part of the Congo forest throughout the year, and we are sure it does not migrate; yet there is no doubt that the ripening of certain fruits, wild and cultivated, influence its local occurrence.

At the post of Avakubi throughout the following May and early June (1914), many hammer-headed bats were to be seen flying about every evening, making their appearance about a quarter of an hour after sundown. They turned their attention at once to the guava trees, fluttering and hovering in search of fruit. They were awkward at plucking the guavas, which are undoubtedly taken in the mouth, for one of them killed by a rat-trap was still clasping the fruit in its teeth. Next the fruit was carried off to some convenient perch — usually bare of foliage, often in a mango tree — perhaps 100 yards away, where they proceeded to cut it up with the teeth, letting drop a great deal of the pulp and probably swallowing simply the softest parts, perhaps only the juice. The elliptical rasp-like patch on the upper surface of the long tongue helps in these operations (Text Fig. 16, p. 485).

So numerous were the bats at this time that spots covered with guava pulp and half-eaten guavas were to be seen on the ground all about the station. Mangos, too, were now ripening, but they were only occasionally consumed. Other fruits known to be devoured by this bat are wild figs, sour sop, and bananas.

Contrary to what we had observed up the river, these bats were mostly immature; but there were a few adult males among them whose voices were sometimes heard. During the day stragglers were found hanging in shady mango trees about the station, but the majority went somewhere else to roost. By the end of June their visits had ceased.

Hypsignathus monstrosus was also heard and seen by us as far up the Ituri as Penge, and on the River Epulu, while at Stanleyville from August to December this call was not infrequently noted, but that of *Epomops franqueti* was the more usual. The species ranges, however, from Lake Victoria (Andersen), through the upper Ituri, northward to Niangara (in the Uele), and westward across the forested portions of the Congo basin and the Kamerun (Bates & Sjöstedt), along the Gulf of Guinea to the Gambia (Büttikofer). It shows a great liking for the neighborhood of water.

The pharynx, larynx, and hyoid bones of various species of *Epomophorus* and *Epomops*, as well as of *Hypsignathus monstrosus*, were carefully studied by Dobson.[1] The last-named species, however, he dismissed with a few words: "There are no posterior air-sacs; but the anterior sacs are well developed, and separated internally below, not by a thin partition as in the above-named species [*i. e.*, of *Epomops*], but by an intermediate sac communicating with the pharynx by an aperture between the mylo-hyoid tendons." Matschie, in 1899,[2] remarked briefly upon the enormous size of the larynx in the male of *Hypsignathus*, and gave a figure illustrating it.

The results of our two dissections are embodied in figures 19 and 20, where the proportions and structure of the larynx, as well as the arrangement of the remaining viscera, are clearly shown. The soft palate is greatly prolonged and divides the pharynx into two separate parts, a large thin-walled nasopharynx and a narrow, thick-walled oropharynx. The lumen of the oropharynx, like that of the esophagus, is so small as to indicate that only the juices of fruits are swallowed.

Into the sides of the nasopharynx open the pair of air-sacs, which lie in front of the sterno-mastoid muscles and just below the parotid glands. We were unable to find, in either of our specimens, the second pair of sacs mentioned by Matschie as lying near the shoulder; and there is no median ventral sac as described by Dobson. A tearing of the muscles of the throat in one specimen, due to the stretching of its neck after preservation in alcohol, at first deceived us, but the cavity we mistook for an air-sac proved to be simply a rent in the areolar tissue of the neck.

The two lateral sacs, according to Prof. H. v. W. Schulte, are perhaps to be looked upon, morphologically, as hypertrophied developments of entodermal pharyngeal pouches — probably the third or fourth pair — and equivalent to the occasional internal branchiogenetic sacs of the human embryo.

In no other mammal is everything so entirely subordinated to the organs

---

[1] Proc. Zool. Soc. London, 1881, pp. 685–693.

[2] Sitzber. Gesell. Naturfor. Fr. Berlin, 1899, p. 28.

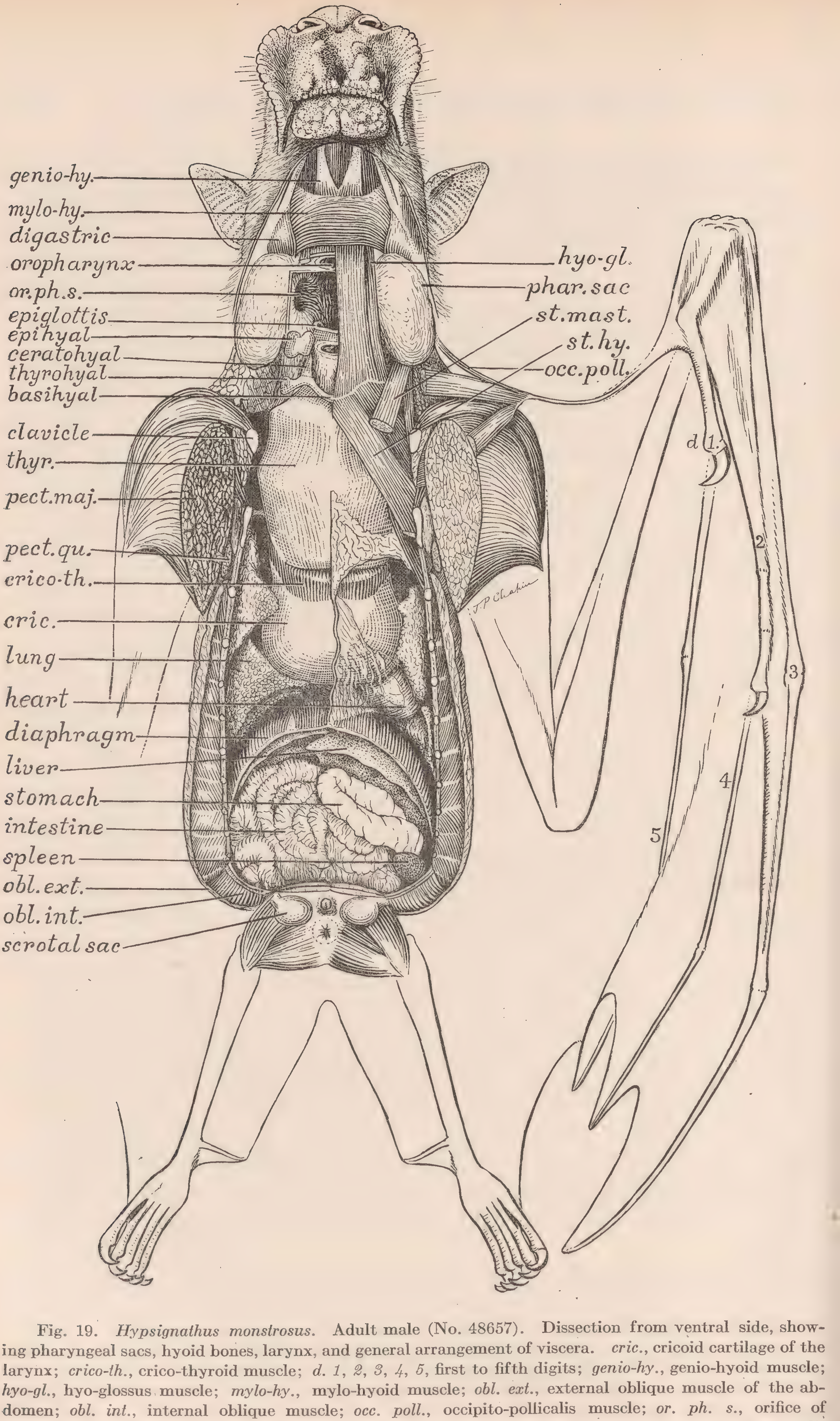


Fig. 19. *Hypsignathus monstrosus.* Adult male (No. 48657). Dissection from ventral side, showing pharyngeal sacs, hyoid bones, larynx, and general arrangement of viscera. *cric.*, cricoid cartilage of the larynx; *crico-th.*, crico-thyroid muscle; *d. 1, 2, 3, 4, 5,* first to fifth digits; *genio-hy.*, genio-hyoid muscle; *hyo-gl.*, hyo-glossus muscle; *mylo-hy.*, mylo-hyoid muscle; *obl. ext.*, external oblique muscle of the abdomen; *obl. int.*, internal oblique muscle; *occ. poll.*, occipito-pollicalis muscle; *or. ph. s.*, orifice of pharyngeal sac communicating with nasopharynx; *pect. maj.*, pectoralis major; *pect. qu.*, pectoralis quartus; *phar. sac.*, left pharyngeal sac; *st. hy.*, sterno-hyoid muscle; *st. mast.*, sterno-mastoid muscle; *thyr.*, throid cartilage of larynx. $\frac{2}{3}$.

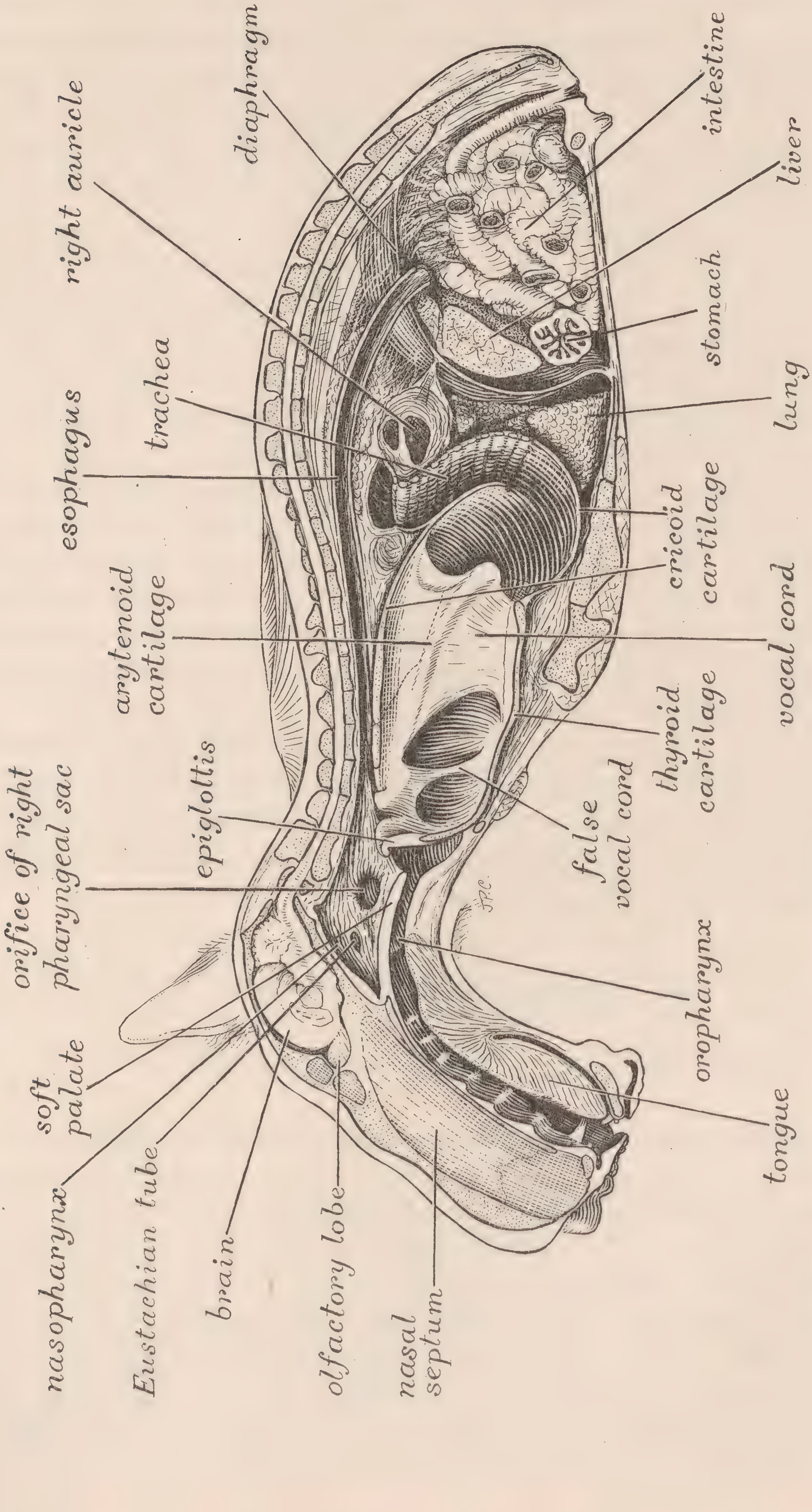


Fig. 20. *Hypsignathus monstrosus.* Sagittal section of adult male (No. 48655), showing pharynx, vocal organs, and viscera. $\frac{2}{3}$.

of voice. In the howling monkey (*Alouatta*), famous for its far-sounding cries, the hyoid is transformed into a resonating apparatus, but in the males of *Hysignathus monstrosus* the importance of the vocal efforts consists not so much in the strength of their noise as in the continuity of their production. We find instead of a fixed ossified reverberating organ, as in *Alouatta*, a pair of air-sacs inflated at will and a tremendous enlargement of the larynx and vocal cords. The sound produced can hardly have any other purpose than to attract the females.

The drawings (Figs. 19 and 20), make it perfectly plain that the larynx, as Matschie says, "is nearly equal in length to one half of the vertebral column," and actually fills the greater part of the thoracic cavity, crowding the heart and lungs back and sideways until the posterior end of the cricoid cartilage is practically in contact with the diaphragm. The trachea is wide, but folded upward on the posterior surface of the larynx. This extreme development of the larynx is simply the result of the enlargement of its usual elements, especially the thyroid, arytenoid, and cricoid cartilages, which have undergone extensive ossification. The vocal cords are extremely broad, and it is our belief that all these modifications have to do mainly with the voice, although Dobson held that the arrangement of the pharynx, hyoids, and their muscles was admirably suited for sucking out the soft interior of fruits.

The whole abdominal cavity is relatively restricted in size. As might be expected from the nature of the food, which consists of fruit-juices, the stomach is rather small, bent upon itself, with its inner lining deeply folded, while the intestine is slender and much convoluted. In both these specimens the alimentary tract was empty.

4. **Ephomophorus anurus** *Heuglin.*

Plate XLIV, Fig. 1, and Plates XLVI and XLVII.

Beyond the northern edge of the forest, the common representative of the family is this medium-sized fruit-bat, with a rudimentary tail, never more than one-third of an inch (6 mm.) in length, right below the interfemoral membrane. The uniform brown color of the back looks more or less faded in the different individuals, and they are still paler on the ventral side, an ill-defined whitish abdominal patch being especially apparent in adult males. These, of course, are easily distinguished from the females by the curious white epaulets and sometimes show a darker band across the breast. An adult male measures 5.75 inches (145 mm.) in length and has a wing-spread of about 21 inches (530 mm.); the females are slightly smaller.

Young in different stages taken during November and January would indicate that they have no definite breeding season, especially as in November a female was found having one embryo.

The larynx of this bat is of normal dimensions, and its note can be heard only a short distance. A captured female when annoyed gave a short whistle, and a chirping sound was often heard by Chapin while waiting at dusk for birds in swampy, wooded places near Faradje. It was repeated with great regularity for some time but would hardly have been ascribed to a bat if we had not had the opportunity of hearing it often. As already stated this was the only fruit-bat common in the region about Faradje, and during daytime was occasionally frightened from its roosts in leafy trees near rivers or swamps. Sometimes they gathered in flocks of 30 or 40 but hung singly or scattered amid the branches of a grove of trees. Securely hooking their sharp claws over a twig, these fruit-bats hang head downward by their straightened legs. Wrapped between the soft folds of their dark wings there is little to be seen of the khaki-colored lump of fur. In fact they often disappear completely between the indistinct blotches of the manifold shadows from the surrounding boughs. If approached during daytime the finely chiseled snout first emerges from its restful pose and the twitching ears and twinkling eyes quickly gather the information that will induce them to take wing (see Plate XLVII). Quite often they were hiding in the dense foliage of rubber-trees (*Manihot*) but if one was shot all the others would fly off some distance to other trees, in spite of the furnace heat and glare of the sun. On two occasions they came into lighted rooms, perhaps in search of bananas hung on the veranda.

We observed *Epomophorus anurus* only near Faradje, but its range extends from the northeastern Uele district into the Bahr-el-Ghazal eastward to Erythrea, across Abyssinia and southward to the Tanganyika.

5. **Epomophorus wahlbergi haldemani** (*Hallowell*).

This bat is rather similar in appearance to *Epomops franqueti franqueti* but is smaller and without the light abdominal patch. An adult male measured 5.75 inches (145 mm.) in length and had a wing-spread of about 20.5 inches (520 mm.). Its shoulder-pouches were well developed, but drawn in so that the rather short white hair did not show. The edges of the sacs were moist, but they had practically no odor.

In some of the groves of cocoanut palms on the beach at Cape Lopez these epaulet bats were not shy but hung from the midribs of the leaves in plain view, half a dozen in a group and sometimes 40 to 50 in a grove. The larynx was rather small, and during the several days our ship lay in this harbor we never heard any noise that could be attributed to these bats.

The range of this species extends from the Kamerun to Angola on the West Coast and across to the East Coast between Zanzibar and 2° north.

6. **Micropteropus pusillus** (*Peters*).

The first sight of this pigmy among fruit-bats is sure to cause considerable surprise. Indeed, measuring only 2.75 inches (70 mm.) in length, with a wing expanse of only 11 inches (279 mm.), it may be compared with a medium-sized insectivorous bat, such as the common American red bat (*Lasiurus borealis*), though of course the latter has a long tail, whereas *Micropteropus* is tailless. Its color is medium brown above but very light below. The white tufts at the base of the ear are distinct, and the adult males have epaulets of the same color.

Though there is one record from the Gaboon, our long experience in the forest, where we never came across this species, leads us to suppose that it occurs only outside in more open country. This is also in accordance with numerous other observations. Its range then extends on the West Coast from Gambia in open places southward to St. Paul de Loanda and probably all along the northern border of the West African rain-forest as far east at least as the Bahr-el-Ghazal, the Uele district, the Semliki River and even to the east shore of Lake Victoria. Our specimen was taken near Niangara.

These and the two following small forms of fruit-bats are probably never as gregarious as their larger relatives nor do they live together in colonies like some of the insectivorous bats. The few we saw were hanging singly or by twos between the leaves of dense bushes, never very high from the ground. Experience shows that they have a much wider range than is generally believed. They have merely escaped the attention of naturalists, who have but scant chances of stirring up these hermits among the fruit bats. Conscious of the perfect protection these small bats are offered everywhere in dense clusters of leaves they are not wary and seldom flutter out of their hiding places.

We believed at first that they did not feed on cultivated fruits, such as plantains or bananas, and therefore would be much rarer in the neighborhood of villages, where we were most successful in getting acquainted with numbers of the larger species. Later we concluded that they might be found everywhere in suitable places, in the middle of the forest as well as in a bush close to a native hut, but we collected them only in the places where we camped for longer periods.

7. **Casinycteris argynnis** (*Thomas*).

Only a single specimen of this rare fruit-bat was previously known from the Kamerun and our record from Medje in the Ituri shifts the limit of its range at once 900 miles eastward. Its queer dentition and other structural characters make it a bat of great interest and any positive clue as to its food and habits would be an important contribution.

Casinycteris argynnis is a rather small, practically tailless fruit-bat of about 3.5 inches (92 mm.) in length. The fine hair on the upper side has the peculiarity of being dark brown at the base, lighter in the center and brown again at the tip. The crown and nape are somewhat lighter. The grayish-white sides of the neck and throat fuse with a patch of the same color that runs down the short-haired abdomen between the gray-brown sides. A white spot behind the nose, where the hair starts to become longer, and one at the posterior corner of the eyes, and a white border on the upper lips are also characteristic of this bat. It is further distinguished by the fact that the wing membrane joins with the phalanges of the first and not with those of the second toe as in all the other fruit-bats we collected, except *Eidolon helvum*.

In the fresh specimens the rather flat nose is a dirty pink, but the skin visible underneath the hair is pale yellowish. The ears have only faint white tufts at their base and are, like the wing membranes, yellowish brown; the phalangeal joints however are much lighter. The eyelids are straw-colored but the round pupil was so large that we almost overlooked the yellowish-brown iris.

Its queer premolars and molars, the enormous spreading of the zygomatic arches that goes hand in hand with a strong and broadened ascending ramus would indicate a crushing rather than a cutting dentition. These characters, together with the short bony palate and the curiously developed palatal ridges, seem indicative of a diet very different from that of ordinary fruit-bats, especially as the shortness of its tooth-row also suggests features typical of insectivorous bats. Unfortunately its stomach was empty, though we found one fœtus (April) in dissecting.

This bat was hanging alone in the dense foliage of a bush only ten feet from the ground at the edge of a native village near Medje, and was the only specimen we saw.

8. **Myonycteris wroughtoni** *Andersen*.

An inconspicuous and very small fruit-bat, it attains only 5 inches (130 mm.) in length, of which the tail absorbs half an inch. The four specimens secured are all from Medje, and they prove that this species varies considerably as to color. The dark brown on the upper side may become considerably lighter and take on even a reddish or yellowish-brown appearance. That this is merely individual variation is shown by a female with a reddish-brown back that was hanging in a bush (in September) together with her half-grown young, also a female. The latter has a dark-brown back and crown like another adult female, but is much darker than its mother. On the short-haired ventral side the difference between the four specimens is not so apparent. In the fresh adult specimens the iris is dark brown, as are also the nose, ears, interfemoral and wing membranes; the latter show on the under side a dark bluish-gray bloom from which the whitish digits stand out conspicuously.

The fine adult male, which was fortunately added in April, 1914, had a broad patch of coarse tawny orange-yellow and gray hairs reaching from the sides of the neck over the shoulders, across the breast, and as far forward as the throat. This peculiar wavy hair was rather unctuous, as a result no doubt of the excretion from the glandular patch of skin beneath. These hairs grow in bundles of ten or more together, whereby a ruffled effect is produced. The females have no specially colored patch on the breast, but show the usual gray or yellowish-brown hair, which however is somewhat longer and slightly kinky. A comparison with the males of *Eidolon helvum* suggests itself, as they have also a patch of coarse, rather shorter, tawny-yellow hair growing over glandular skin like the males of *Myonycteris wroughtoni*, but in *Eidolon* the tawny-yellow hair does not extend as far forward and grows in the ordinary manner, not in bunches. The females too of this species have a patch of yellowish hair but much longer, fine, and silky.

In many fruit-bats, *Eidolon, Epomophorus, Pteropus, Myonycteris*, and many others, the patches of coarse hair on the breast, at the base of the wing or on the mantle are distinctive features of the adult males. In the epomophorine bats the epaulet is peculiar, being a pocket lined with white or yellow hair which is also coarse. Connected with such patches is always a cutaneous glandular formation. The hairs at least at certain periods are moist or unctuous, sometimes slightly odorous.

Myonycteris wroughtoni was previously known only from the Likati River, 240 miles west of Medje, where it had been collected by the Alexander-Gosling Expedition in 1906.

MICROCHIROPTERA.

EMBALLONURIDÆ.

9. **Taphozous mauritianus** *Geoffroy.*

Plate XLVIII, Fig. 1.

The pointed short-haired muzzle, the large eyes, the erect ears, the light-grayish, peculiarly freckled tints above, and the pure white below give to this tomb-bat its clean appearance, which is further enhanced by the glistening effect of the smoothly appressed hair. The wing membranes are white, nearly translucent, and appear quite conspicuous when they fly during daylight. The glandular pouch under the chin is not so well marked in the females as in the slightly smaller males.

They have only one young and breed probably throughout the year, as proved by several half-grown young collected in April, May, November, and December and also by records of an embryo in May and of a young one still clinging to its mother's breast in April.

In Faradje where they were the commonest bat and had established themselves in all the houses, they did not care in the least for dark places in the interior of buildings, nor did they hang from the rafters as do *Hipposideros caffer centralis* and *Nycteris hispida,* but preferred to cling along the outer side of the brick walls right below the thatched roof. Here they could be easily observed, and it was apparent that their folded wings were of as much assistance to them as their feet while clambering along the bricks. Sometimes as many as a dozen were seen along these walls, though each one kept by itself. If one walked immediately below them they would shift nervously sidewise or climb on top of the brick walls, only to return when the disturbance had ceased. Rarely would they fly out into the sun to hide in some shady place in a tree or other building.

They appeared later than other bats, in fact only when complete darkness had set in, so that it was impossible to shoot them in flight. They seldom entered lighted rooms. As they flew out from beneath the roof or made sudden turns a peculiar whirring sound could be heard, probably caused by a skin-fold that runs from the radius to the base of the fifth digit and is characteristic of the genus *Taphozous.* Their well-developed wing muscles indicate the rapidity and great power of their flight. According to stomach contents their prey consists chiefly of small moths, undoubtedly captured on the wing, and we have no evidence whatsoever to support Mr. E. C. Buxton's statement that one species of *Taphozous* (*T. affinis*) is a fruit-eater,[1] nor have we found any African microchiropterous bat feeding on vegetable matter.

During flight when following each other in rapid turns or when moving about on the brick walls, they often fight together and make a screeching sound.

We found them very numerous in the bushveldt region north of the forest, especially at Niangara, Faradje, and Yakuluku. There were none at Medje, which is situated in the forest. Around Avakubi large clearings are numerous and though situated in the midst of the Ituri forest the houses of this post sheltered a few of these bats throughout the year. *Nycteris* and *Hipposideros*, however, were the common bats. We believe therefore that *Taphozous mauritianus* is typical of the bushveldt country and practically absent from the dense tropical rain-forest.

The range includes Tropical and Southern Africa, Madagascar, and the Mascarene Islands.

10. **Taphozous sudani**, *Thomas.*

This recently described "tomb-bat" has a uniform dark-brown color with only slightly paler under side. Its total length of 4.25 inches (111 mm.) and wing-spread of 15.75 inches (400 mm.) show it to be a bat of somewhat smaller size than *T. mauritianus.* The greater portion of the wing membranes are likewise white and translucent, and there is a naked triangular patch on the forehead in the small depression between the anterior edges of the ears, but the gular pouch is absent.

About 150 to 200 bats of this species were found in a large fissure in the steep side of a rocky hill a few miles west of Dungu. They were clinging to or crawling along the surface of the rock and by their behavior reminded one strongly of *T. mauritianus.* They preferred however to stay within the shelter of the darker places, and took wing when disturbed, though they made no vocal noises. They never crawled over each other, but sometimes would sit so close as to form great dark patches against the rock. The contents of the stomach show that they feed exclusively on insects.

The range of this species, formerly recorded from Mongalla on the White Nile, is extended over 300 miles to the southwest by these specimens collected in the northeastern Uele district.

---

[1] Dobson, Catalogue of Chiroptera, 1878, p. 390.

11. **Saccolaimus peli** (*Temminck*).

Plate XLIX.

The uniformly blackish or dark-brown color and large size distinguish it at once from all its other African relatives. The somewhat larger females attain a maximum length of 6.12 inches (157 mm.) and a wing-spread of 27 inches (685 mm.). Thus *Saccolaimus peli* has the distinction of being the largest insectivorous bat of the African continent and is approached only by *Hipposideros gigas*. A semi-circular frill forming the border of a peculiar horseshoe-like shallow glandular pouch under the split chin is also an external characteristic, well marked in both sexes.

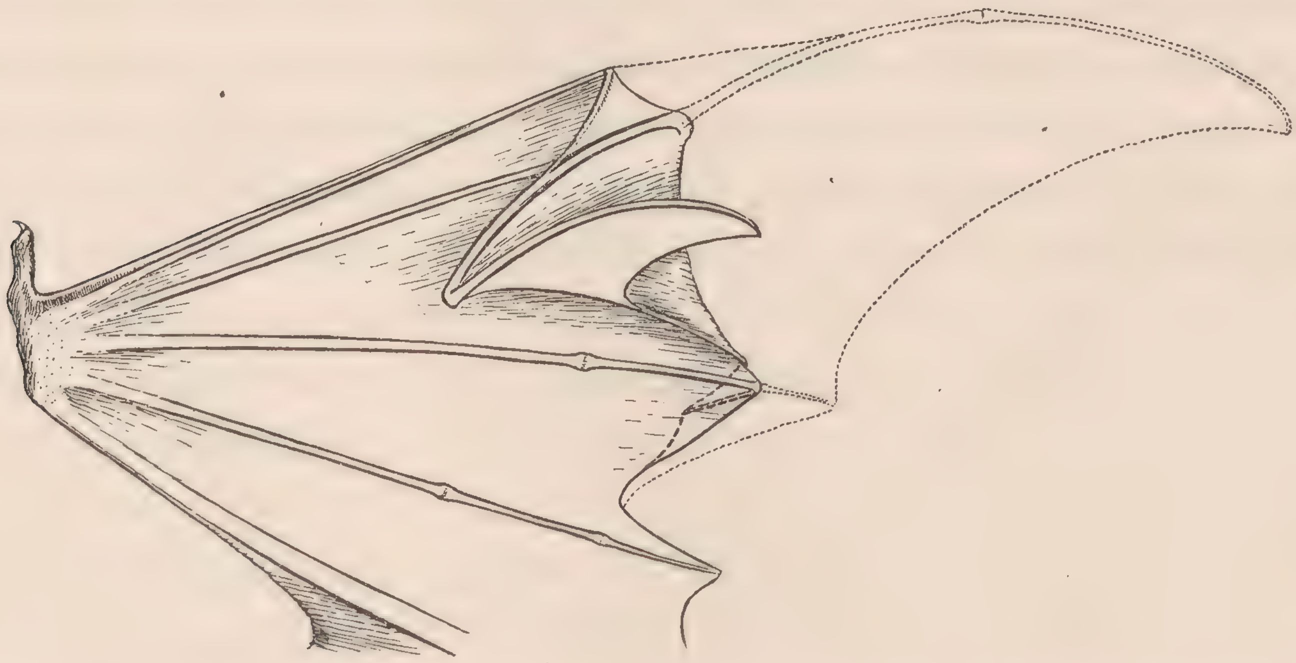


Fig. 21. *Saccolaimus peli.* Wing from above (No. 49350), to show folding of the tip (wing with tip extended shown by dotted line). $\frac{1}{2}$.

When at rest the tips of the wings are folded back on their upper surface in a very curious manner (Fig. 21). The third and longest digit has only two phalanges, of which the proximal one is turned upward but the terminal one backward again. With the wings thus shortened to nearly half their whole length they can, as we have seen in live specimens, climb about more easily in the rough interior of hollow trees when seeking for a propitious place to rest. When wounded and brought to the ground they bite savagely and in trying to escape use their folded wings to great advantage, since with their aid they scurry over the ground much more rapidly than other bats.

The short free tail, as in all Emballonuridæ, is loosely enclosed at its base in the wrinkled interfemoral membrane. Thus in flight, by stretching their hind-limbs, this membrane slipping quite easily over the tail-vertebræ, can be considerably lengthened. So by pulling in or moving out their legs, these bats can set their sail, as one might say. This arrangement would help to explain the extraordinary skill of these fast fliers in steering about.

Out of ten females, three taken in June and December, each had a single fœtus. Therefore we may state that they have one young and breed at different seasons.

Throughout the year, shortly after nightfall, but especially on moonlight nights, a dozen or more of these skillful flyers may be observed sailing swiftly over the open village places. Usually they travel at a height of some 30 feet or more but very often when diving after their prey they come down in such elegant and rapid swoops as to resemble more a hawk than a bat. One can then distinctly hear the reiterated short chirping or squeaking notes uttered during flight. In foggy weather they fly very low, since the insects upon which they feed are evidently forced by the dampness to keep close to the ground. During the daytime they retreat into hollow trees where they cling to the walls singly, not forming clusters as the bulldog or molossine bats habitually do. Though their feeding grounds are chiefly the open places about human settlements we never found them in houses like *Taphozous mauritianus*. We often wondered why they disappear again so soon, but a specimen shot only half an hour after their arrival in the village clearing had its stomach already gorged with the well-chewed remains of tiny insects.

They may be considered typical of the region of equatorial rain-forests, as they seem to be absent from the bushveldt to the north of Niangara, although in the latter place they are still common. The large forest galleries along the Uele and its affluents evidently still furnish a suitable environment.

The range of this bat extends all across Tropical Africa from the Gold Coast and Kamerun to East Africa, though for the latter record the exact locality is not known.

12. **Colëura gallarum nilosa** *Thomas.*

Externally this bat is a small copy of *Taphozous sudani*, with the hair sooty-brown, becoming whitish at the bases. The thumb however is relatively longer, and the tail slightly shorter, though it protrudes above the interfemoral membrane. The gular sac is but slightly developed. The tip of the wing folds back exactly as it does in *Taphozous* and *Saccolaimus;* moreover the joint that thus becomes virtually the tip of the folded wing is protected by a pad-like thickening of the skin, no doubt preventing injury from the rough rocky walls of its home. Expanse of wings 11.5 inches (290 mm.), total length 3 inches (77 mm.), tail .62 of an inch (16 mm.).

The region of Aba, whence all our specimens come, is on the divide between the Congo and Nile basins; but this is not to be pictured as an abrupt mountain chain. Quite the contrary, for it is only a rolling bush country, some 2800 feet above sea level, studded however with great numbers of rugged granite hills rising from 300 to 500 feet higher. As one follows the road from Aba to Yei, the point at which one leaves the Belgian Congo and enters the Lado would be scarcely noticeable were it not marked to the left by one of these hills known as the Libugu, literally "the rock," a well-chosen name for this great gray monolith, exceptionally bare and some 200 feet high.

Just as these hills are inhabited by a number of birds not found in the more level country to the southwest, so too they have certain peculiar mammals, notably hyraxes; and their fissures and grottos harbor, as one might well guess, numbers of bats. Extensive caverns we never saw; in igneous rocks one would not expect them; but in our climbs about these heights and cliffs we often set dark forms fluttering in the recesses, where however they were difficult to secure with the gun. The natives were naturally far better acquainted with the neighborhood and long practised in the art of bat-catching. We were aided particularly by the people of chief Ibu, a Logo; they knew the caves well, and when colonies of bats had been located they were smoked and stifled or beaten down as they tried to escape through the smaller openings. Near Aba eight species of Chiroptera were taken thus in the hills, several others being collected in other refuges, such as houses and banana plants. Here, as with the bats inhabiting hollow trees, it was found that colonies of the more abundant kinds were composed mainly of a single species, although some of the rarer ones (*e. g.*, *Rhinolophus axillaris*) may mingle with their commoner fellows.

The close resemblance of *Colëura gallarum nilosa* to *Taphozous sudani* is not restricted to external appearance, for both bats have the same habits and frequent similar sites. At Aba the smaller species lives in the caves, clambering about on their weathered gray walls, where its coloration is decidedly protective. Here it is very likely near the southwestern border of its range, for the species inhabits Northeast Africa; and this race, distinguished by the light bases of its hair, was described from the Nile region.

NYCTERIDÆ.

13. **Nycteris hispida** (*Schreber*).

All the members of this genus found in the Congo are clothed in long soft fur of a brown or gray-brown color. They are very easily recognized on account of their large ears, minute eyes, the deep frontal groove hidden by the nose-leaves, and the long tail, which composes about one half of the total length. Its tip is curiously bifid, Y-shaped, serving as a support for the edge of the interfemoral membrane. Both wing and tail membranes are traversed by numerous fine lines; on the inner part of the wing these intersect at right angles, and have little dark spots — sensory organs no doubt — at their crossings.

Externally the various species differ but slightly in color and size, and in the length of the ears. Of the species enumerated in the present paper, *Nycteris arge* and *N. avakubia* have the longest ears, *N. pallida* the shortest.

Nycteris hispida, whose ears exceed only slightly those of the last-named species, is very common in the forested region of the Ituri and about Stanleyville. There it is one of the bats most often seen flying about the villages, and one of those to enter most frequently lighted rooms at night. The pursuit of small insects drawn to the lamp is then its real aim. Along with it may come *Nycteris arge* and *Hipposideros caffer centralis*. Sometimes we would close all the windows and try to catch them with butterfly nets — a warm but exhilarating sport. Now thoroughly frightened, they flew round and round the room, close to the ceiling, dodging our strokes with incredible agility, and hanging up from time to time in distant corners. Or down they fluttered repeatedly to the doors or windows by which they had entered, seeking a way out. Seldom could we net them until they were completely tired out, and not infrequently they eluded us entirely.

During the day *Nycteris hispida* sleeps suspended by its feet from a rafter in some dark, unused room, where seldom more than three or four gather, or swinging from a twig in a mango or other shady tree, a most grotesque little creature with twitching ears, but attracting no attention because of its small size. One fœtus was found in the uterus of a female at Stanleyville on August 8.

At Boma bats of this species were not seen in the houses, but fed about the papyrus in the evening just as *N. pallida* does in the Upper Uele. The type locality is Senegal, but Dobson records specimens from Khartum to the Cape of Good Hope.

14. **Nycteris pallida** sp. nov.

The smallest and the palest of our species of *Nycteris*, only 3.75 inches (95 mm.) long, was discovered in the papyrus swamps about Faradje and Vankerckhovenville. In this open country of grass and bush, the hollows are very often occupied by long winding marshes filled with this noble sedge, which offer refuge to a fauna quite their own. As the darkness is falling rapidly, flocks of weavers drop in to roost, the slaty-black crakes (*Limno-*

corax niger) cluck softly as they thread their way among the papyrus stalks or climb up for the night. Then new evidences of life appear, the flickering shapes of small gray bats, fluttering in and out, in most aimless fashion, along the pathways or tunnels through the vegetation, which rises to a height of 12 to 15 feet. About its borders they also hover, always looking as though just about to hang up, raising in the zealous collector's breast false hopes of a more favorable shot in the fast deepening twilight — hopes which are never realized.

During the day these little bats are more difficult to find, for they retire farther into the swamp, where mud and water are deep and the way barred with tangles of old dry stalks. They never collect in large parties, but are generally seen to take wing singly, fly 15 or 20 yards, and hang themselves up again just beneath a bushy papyrus crown, where they are anything but apparent.

These papyrus swamps offer good shelter throughout the year, because they are usually spared by the fires that sweep the bushveldt annually. Though they dry out considerably by the end of the rainless season, it is in December, while they are still filled with water, that most of these bush-fires take place.

Nycteris pallida was never observed in houses, but is sometimes to be found hanging in the tall bamboo reeds along the bank of the River Dungu. Its young appear to be born at the beginning of the rains, as two females taken on April 18 were each carrying one about with them.

15. **Nycteris avakubia** sp. nov.

The single example of this new species, which closely resembles *N. arge* though of larger size, was taken in a house at Avakubi, where three representatives of the genus live together. Fig. 3 (p. 426) is copied from a water-color sketch made from the specimen the day it was caught.

16. **Nycteris arge** (*Thomas*).

The common long-eared *Nycteris* of the Ituri forest and southern Uele has a tail as long as the head and body, measuring 4.5 inches (114 mm.) over all. Its wings spread 10.5 inches (267 mm.). As noted under *N. hispida*, this species is seen commonly about houses, circling around in illuminated rooms, or perhaps flying back and forth for long periods beneath a veranda roof, noiseless save for the light pulsations of its wings when it makes a sudden turn. It may remain during the day in deserted dwellings, suspended from the roof by its small feet.

The type locality of the species being Efulen, Kamerun, the present records extends its range very widely to the east.

17. **Nycteris major** (*Andersen*).

This large species, whose wings when spread measure 12.25 inches (311 mm.) has ears not quite so long as those of *N. arge*. It was found by us only in the open country, at Faradje and Garamba; but even there it is not common. Strangely enough, the species was described from the Ja River, in the forested part of the Kamerun.

MEGADERMIDÆ.

18. **Lavia frons affinis** *Andersen & Wroughton*.

Plate L.

The curious orange, yellow, greenish, and brown tints are spread so harmoniously over the huge nose-leaves, the enormous ears, and the broad wings that one is surprised to find such strange beauty in a bat otherwise so modest in its slate-gray, long-haired body. Its length of only 3.12 inches (79 mm.) would be deceptive if compared with that of other insectivorous bats. The tail in the Rhinolophidæ is very long, but in the genus *Lavia* is reduced to a coccyx and therefore not visible externally, though the interfemoral membrane is very well developed (Fig. 22, *B*). Even its wing-spread of 15 inches (380 mm.) appears small if one remembers the broad outlines of the bat on the wing. There is a tremendous contrast between the rapid direct flight of *Nyctinomus*, with its narrow pointed wings, and the unsteady wavy dashes of *Lavia frons*, with its clumsily rounded wings,— indeed just as between a swift-sailing falcon and a fluttering grouse.

Adult males have peculiar yellow glands in the skin of the whole lower back, over which the long hair, otherwise slate-gray, assumes a brownish tint, apparently colored by the slightly odorous excretion. Right above the anus the females have two teat-like excrescences (5 mm. in length) common in the Rhinolophidæ.

One large fœtus in March and five young taken from October to April, would prove that they have only one young and breed at different periods. We did not notice them from May to August, as they become much less conspicuous when the foliage is denser, but we believe that they reproduce throughout the year.

The young, as in other bats, clings to the breast of its mother and is thus carried about even during flight. We were rather surprised to see that one, four-fifths the size of its mother and able to fly, was not only carried about occasionally but still depended for its nourishment entirely on sucking, since its stomach contained only milk. As the young grows larger, the mother hunts alone, leaving her offspring hanging to a twig, but on her return it quickly climbs back to its accustomed place on her breast. If the mother is scared away the precious burden is never considered too heavy to carry.

They are far more diurnal than any other bat we observed, and this has been corroborated by all travellers who have seen them. They seem to have no definite time for sleep, as they proved to be wide awake even when approached cautiously, and do not mind the glare of the sun. When disturbed they took wing quickly, turning with such sureness toward another tree that they seemed to have selected long before the branchlets where they wished to cling.

They were common at Faradje, where they liked to swing from the twigs of rubber trees (*Manihot*) either by one or both feet. They did not disdain protection in the dense foliage, but in December and January often hung on bare twigs, shifting to a more shady place if the direct rays of the sun struck them. Thorny, sparsely-leaved trees, such as acacias, to which they like to cling in eastern Africa, are not numerous in the Uele district.

At Faradje many bats hunted every evening; some high in the air over open spots like *Taphozous mauritianus*, others like *Mops* showed a liking for the free expanses over the Dungu River, while *Eptesicus faradjius* kept close to the ground near the houses. All of these had small ears and hair-covered or fleshy muzzles and flew in the open. But it was evident that *Lavia frons affinis* derived some genuine advantage from its big, highly sensitive nose-leaves and tremendous ears. No doubt it is also greatly assisted by the fine reticulation of sensory nerves which are extremely well developed in the membranes. It certainly can dodge in and out between the bushes and trees with an ease that calls forth admiration. Starting to forage early, before sunset, it would never remain on the wing in the same constant manner as other bats but alighted very often between mouthfuls of tiny, hard-shelled insects.

Late in January not far from their roosting trees the grass was set afire just about noon. As usual, insects, to escape the advancing flames, tried to hide in great numbers in the grass. These bats would then dive after some of the insects that passed nearest, just as eagerly and skilfully as the birds that snatched them far above the flames. Their method is utterly different from that of other bats, which feed with such ease on the wing that one can seldom ascertain whether or not they have been successful in their pursuit. These long-eared bats after seizing an insect return at once to their perch. Here they move about nervously, busy with either foot or wing until the tiny jaws have disposed of their prey. They feed on relatively large insects with rather hard integuments, as shown by the contents of their stomachs.

Colonel Roosevelt gives a most interesting and vivid account of their feeding habits in his 'African Game Trails,' page 399:

> "In catching insects they behaved not like swallows but like flycatchers. Except that they perched upside down so to speak, that is, that they hung from the twigs instead of sitting on them, their conduct was precisely that of a phœbe bird or a wood pewee. Each bat hung from its twig until it espied a passing insect, when it swooped down upon it, and after a short flight returned with its booty to the same perch or went on to a new one close by; and it kept twitching its long ears as it hung head downward devouring its prey."

The wide range of the genus *Lavia* across Tropical Africa outside of the equatorial forests seems to be dependent on the neighborhood of water which, of course, only indirectly influences its distribution. Many of the rivers, swamps and lakes, even in the more arid regions, are fringed with trees and bushes that offer very convenient roosts. These bats are usually found in just such sites, but they avoid houses and cliffs. Another reason may be that in the neighborhood of water and, particularly about swamps, certain insects upon which they like to feed are especially common.

RHINOLOPHIDÆ.

19. **Rhinolophus hildebrandti eloquens** *Andersen.*

A rather light brownish-gray horseshoe-bat, with very dark-brown wings. Compared with *R. abæ*, from the same region, it is seen to be slightly lighter in color, with larger ears. Its measurements are greater throughout; total length approximately 3.75 inches (95 mm.); tail about 1.1 inches (28 mm.); expanse of wings 14 inches (355 mm.).

Our three specimens from Aba were captured in caves, where they mingled with *Rhinolophus abæ* and other bats. They extend the range some distance to the northwest, as this small race of the East African *R. hildebrandti* was first found in Uganda.

20. **Rhinolophus abæ** sp. nov.

Fur rather long and soft, grayish-brown above, drab on abdomen; wings dusky brown. Outlines of ears and nose-leaves are similar to those of *R. hildebrandti eloquens* and *R. axillaris*. Total length, 3.3 inches (84 mm.); tail 1 inch (24 mm.); spread of wings 12.7 inches (320 mm.).

From our experience in December, 1911, this appeared to be the commonest *Rhinolophus* living in the rocky hills about Aba.

21. **Rhinolophus axillaris** sp. nov.

Plate LI, Fig. 2.

The specific name refers to the two patches of stiffened rufous hairs, usually found on the sides of the breast, just outside the mammæ. Their function is obscure, but in one of our specimens, a male, the hairs are pale yellowish, and a hardened gummy secretion adheres to them. This individual, moreover, is lighter and yellower in the rest of its pelage, being cinnamon on the back, and pale cinnamon-buff below. The five other specimens are gray-brown, similar in color to *Rhinolophus abœ*. Average measurements are: total length 3.1 inches (79 mm.), tail 1 inch (26 mm.).

This is not a common species, even at Aba, the only locality from which it is known. Two examples were first captured singly in caves inhabited by other bats, *Rhinolophus* and *Hipposideros;* and then three were brought to us by some natives, in a basket containing also specimens of *R. abœ* and *R. hildebrandti eloquens*.

Certain of these forms now known only from Aba, may perhaps range southwestward to the hills near Vankerckhovenville, where conditions are very similar.

22. **Hipposideros caffer centralis** *Andersen.*

Plate LII, Fig. 1.

It would be difficult to describe in detail the coloration of the common leaf-nosed bat; so variable is the pelage that different individuals appear to represent distinct species. Some shade of brown is most frequent, with the under surface only slightly lighter, but many are dark brownish-gray (probably young), whereas a few of either sex are of a beautiful bright cinnamon-rufous over the whole body, the flight membranes always remaining brownish-black.

The ears are comparatively short and wide, dark gray like the nasal outgrowths (Plate LII, Fig. 1). Just above the latter, hidden in the fur of the forehead, the males have a small invagination of the skin, through the opening of which protrude a few wisps of hair. There is no eversible pouch near the anus as in *H. langi,* and females lack even the frontal sac, but have a very small bunch of short, stiffer hairs at that point. The pair of vestigial mammæ in the pubic region are usually small in the females, practically absent in males.

Exact measurements are rather variable, but the usual length is about 3.5 inches (90 mm.), with a tail of 1.4 inches (35 mm.), and the wing-spread is 11.4 inches (290 mm.).

One cannot travel very far in the Upper Congo without making the acquaintance of this rather sociable species. Arriving after a long march in a government station, we are met and warmly welcomed by the courteous chef de poste, who accompanies us at once to the house placed at our disposition, probably a cool brick structure with loosely fitting wooden blinds at the windows, and plenty of open space for ventilation between the walls and the gabled roof. Such a house is ideal for the region, in so far as materials are available, and a welcome change after weeks or months under canvas and in mud-walled rest-houses.

Perhaps it is a long time since some passing officer last occupied it. The door is unlocked, and in go our boys to install our camp furniture. Everything is dark, and a slight musty odor is perceptible. A number of dark forms, worried by this unwonted disturbance, flit about the room. But our boys are wise in the ways of bloodthirsty mammalogists. They come out again, close the door cautiously and report: "There are birds in the house." 'Ndeke' however means bats as well as birds, so preparations are made to secure specimens, and butterfly nets pressed into service.

Our Belgian friend meanwhile looks on with kindly amusement, and we cannot help laughing at our own awkwardness and the adroitness of our quarry; but the joy of success is not always complete. Nine times out of ten, we have to conceal a slight disappointment, for we have only captured an old friend, *Hipposideros caffer.* Small wonder, for this is the commonest bat in abandoned native huts, old outhouses or magazines, or any other darkened untenanted building, where they gather in numbers up to 50 or 60, hanging to the walls or ceiling, making little disturbance and flying with scarcely a sound. When forced to leave they make for the nearest retreat in some adjoining house; it goes without saying that they are perfectly acquainted with the neighborhood.

Native huts, while inhabited, offer no suitable refuge, on account of the great simplicity of their structure, and mainly because of the smoke from the fire, which even in hot equatorial Africa is kept burning there, especially at night. Small colonies may however be found in the sepulchral huts left in the midst of villages of the forest negroes. It is only natural that a bat roosting so often in houses should not hesitate to enter them at night; and so, among the bats we captured in lighted rooms where they had come in pursuit of insects, *Hipposideros caffer centralis* was the most common. Only at Aba did we find it in caves, and even there we took but 3 specimens.

The range of this subspecies extends in a belt across Equatorial Africa from British East Africa to the Lower Congo, while other races of *Hipposideros caffer* occupy the remainder of tropical Africa.

23. **Hipposideros caffer niapu** subsp. nov.

The 10 specimens upon which this new subspecies is based were taken in a large shed at Niapu, where a flock of about 50 were making their home. They did not differ in habits from *H. c. centralis.*

The frontal sacs are better developed in the males then in *H. c. centralis,* and the same is true of the abdominal mammæ of the females. The forearm is longer, the wings spreading 12.7 inches (323 mm.), while the length is about 3.5 inches (88 mm.), with a tail of 1.2 inches (30 mm.).

24. **Hipposideros abæ** sp. nov.

The texture and often the color of the fur is rather like that of the species of *Rhinolophus* which frequent the same haunts. Individuals are numerous which show an ochraceous-tawny color, brightest below, for the fur of the back is tipped with dark brown. These dark tips always persist, but the rest of the hair is more often of a pale smoke-gray. The broad wings are brownish black, with an expanse of 12.6 inches (320 mm.); the length from nose to tip of tail is 4 inches (102 mm.), the tail 1.4 inches (36 mm.).

Males have a frontal sac enclosing dark stiff hairs; females have a bunch of hairs without the sac.

This is perhaps the commonest of the cave bats about Aba, and lives in flocks of hundreds in the darker recesses, taking wing when disturbed, but very averse to risking itself out in the open sunlight.

25. **Hipposideros nanus** sp. nov.

A very small species, as shown by its measurements: total length, 2.6 inches (66 mm.); tail, 1 inch (25 mm.); expanse of wings, 9.7 inches (246 mm.). It bears some resemblance to *H. caffer,* but the fur extends higher up on the back of the ears, and the coloration is lighter. The pelage of the back is hair-brown at tip and base, whitish in the intervening portion; whereas that of the under surface is drab at the tip, grayish-white subterminally, and the basal half deep mouse gray. The membrane of the wings is blackish brown.

Represented in the collection by only a single specimen, secured in a house at Faradje.

26. **Hipposideros langi** sp. nov.

Text Figs. 4–6, pp. 435–437.

The hair all over the body of this large leaf-nosed bat is exceptionally long and fluffy, for the most part dark brown, but becoming lighter and grayer just before ending in the blackish tips. The broad wing membranes are likewise dark brown, and the short tail makes up only about one-fourth of the total length of 4.45 inches (113 mm.); 16 inches is the extent of the wings.

More unusual than the complex nose-leaves are the curious eversible pouches (Fig. 4, p. 435), lined with long stiff hairs, which adorn the forehead in both sexes, though they may be concealed by the surrounding fur. These are found in several related species, like *H. gigas*. But the male of *H. langi* has another much larger pouch between the penis and anus, with glandular skin producing a strong odor, which might perhaps be mistaken, when evaginated, for a scrotum. As a matter of fact, however, the testes are placed wide apart, lateral to the penis, and covered by ordinary hairy skin. The pouch can be turned out after death by pressure on the surrounding skin, and exposes its stiff rufous hairs as shown in Fig. 6 (p. 437). Though lacking in the female, it is represented perhaps by the longer hairs arising in front of the vagina (Fig. 5, p. 436).

The frontal pockets are already well developed in half-grown young, which like the adult males show rudiments of the two teat-like processes found close together in the pubic region. The latter are especially long in adult females (Fig. 5) but not connected with mammary glands. Possibly these appendages are sucked by the young and aid the mother in carrying them.

Very seldom is this bat seen flying about at night, perhaps because of a dislike for open spots; and yet it is not rare, sometimes roosting in parties of a dozen. According to native informants they hang in the dense foliage of trees and bushes, but at Avakubi we found a large hollow tree in the rubber plantation tenanted by them. Its cavernous trunk opened only near the ground; and standing in this aperture, one could hear the muffled beat of their wings when they were disturbed. By shooting blindly up into the darkness three specimens were secured, and another was taken by smoking. In spite of these disturbances they returned to this retreat during four months.

Among six examples captured in late April three were very young, and two gravid females were collected towards the end of January; so February is evidently the month, in the Ituri, during which they bring forth their young.

Hipposideros langi is clearly a forest species, and certainly of wider distribution in the Ituri than indicated by our records, though probably reaching its northern limit near the Uele River.

27. **Hipposideros gigas niangaræ** subsp. nov.

Plate LI, Fig. 1.

Though the distinction of being the largest insectivorous bat of Africa is claimed for *Saccolaimus peli*, the present subspecies misses it by only a fraction of an inch. In spite of its short tail it measures 5.4 inches in length (137 mm.). The wings when fully extended show a width of 25.6 inches (650 mm.). Their long-haired, light brown shoulders are limited on the back by a Y-shaped band of short dark brown hair that reaches forward to the white base of the wings, a combination distinctive of this genus. The face and under side are buffy gray. The peculiar nose-leaves, the bristly hairs and sharp-tipped ears are well shown in a photograph (Plate LI) taken from the fresh specimen.

On the forehead there is a small sac, as in *Hipposideros langi*, with bristly hairs; but our specimen is a female and shows only a patch of long hairs in front of the vulva.

This is not a common species in the regions where we collected, for the only specimen we saw flew in under the veranda of a house at Niangara one evening in early June. It had been gorging itself with winged termites, remains of which were still stowed in its capacious cheeks.

VESPERTILIONIDÆ.

28. **Myotis bocagii bocagii** *Peters.*

This is the smallest of the three subspecies of *Myotis* represented in our collection. Though nearly adult our specimen measures only 2.75 inches (70 mm.) in length. The color is cinnamon above, light gray below, and the wings are darker than the ears. When it is compared with similar specimens of *Myotis bocagii cupreolus* the difference in size is greater than between the latter and the largest race, *M. bocagii hildegardeæ.*

This bat with its cinnamon upper side attracted our attention as it was being carried across the courtyard by a chicken, which had evidently found it dead in the garden. Fortunately it was still in good condition.

29. **Myotis bocagii cupreolus** *Thomas.*

Its gorgeous color together with its small size place it among the really beautiful bats. The vinaceous-rufous and ferruginous tints of the upper side bordered by the blackish wing membranes and fusing into the pinkish cinnamon of the under side make a pleasing combination of colors. The obtuse muzzle and the tiny eyes are practically hidden in the fur of the head, from which emerge laterally the rather long ears, slightly rounded at their tip and concave on their posterior edge with a narrow tragus reaching to their middle. Its total length is but 3.4 inches (87 mm.) and the expanse of the wings 10 inches (255 mm.). According to the contents of the stomach, this species feeds on minute insects of great variety, including remains of Orthoptera. Only one young is brought forth, as two records tend to prove, the first from the beginning of January, a large embryo, and the second from the end of June, a very young male still hairless on the under side but already showing on the upper side the rufous coloration of the adults.

With regard to its habits it may be introduced as a close associate of that other more common vespertilionid, *Pipistrellus nanus* (p. 441). Indeed the Mabudu at Bafwabaka, who are well acquainted with them, often catch both species, as they drive them out of the same bunch of bananas; and they call this coppery banana bat the "big red brother" of the dark pipistrelle. Among their own tribe they have a few people considerably paler than the black majority, and to avoid all doubt as to the interrelationship of the bats they point to such light-brown individuals among themselves. Then they feel happy that they can offer such convincing proof to the white man, "whose brothers are always white."

Our series of skins shows that adult males of *Myotis bocagii cupreolus* are of a distinctly brighter vinaceous-rufous color than females and young, especially on the lower back, whereas in *Myotis bocagii hildegardeæ,* which is paler, both sexes attain the same intensity in the rufous hues.

It is perhaps interesting to note that in referring to *Myotis bocagii* and in describing *M. bocagii cupreolus* and *M. bocagii hildegardeæ,* Thomas[1] made some remarks on the comparative brightness of color of these forms which our larger series from the same locality would show to be purely individual. Dr. Allen has pointed out (p. 440) that "the length of the red tips to the hairs of the back varies from 2 to 5 mm. in length in specimens taken the same day." Furthermore the length of the hairs, given by Thomas as 5 to 6 mm., in our series of both subspecies varies from 4 to 8 mm. and the longer ones appear somewhat shaggy. The bright color cited above may, in worn specimens, fade to cinnamon on the back and paler on the under side. The specimens with very short red tips look somewhat dusky since the dark bases show through.

---

[1] Thomas, O. Ann. and Mag. Nat. Hist. (7), XIII, 1904, p. 407; p. 209.

Our specimens are all from Bafwabaka and Medje, but the type locality is Efulen, Kamerun, nearly 1000 miles westward across the forest. Its habits would indicate that it has as wide a distribution as *Pipistrellus nanus*, but since it seldom visits villages and keeps away from houses it is not liable to come to the notice of travellers.

30. **Myotis bocagii hildegardeæ** *Thomas.*

In addition to the remarks under *M. bocagii cupreolus* we may state that this is an equally pretty bat though slightly paler and somewhat larger. Its total length is 3.55 inches (90 mm.) and the spread of wings 10.25 inches (260 mm.).

We found it living in the same banana plantations with *Pipistrellus*, though most of them were found hiding beneath the dead overhanging leaves of plantains and only a few between the fruits in the bunches.

Myotis bocagii hildegardeæ undoubtedly replaces *M. bocagii cupreolus* outside the rain-forest in the more open country. Its type locality, Fort Hall at the foot of Mt. Kenia, lies nearly 600 miles eastward of Aba.

31. **Pipistrellus nanus** (*Peters*).

This pipistrelle is one of the very small African bats; it measures only 3 inches (76 mm.) from the nose to the end of the tail, the latter accounting for nearly half the length. The expanse of the dark wings is 7.25 inches (184 mm.). The fur is darker basally, and though warm sepia is the most common shade, blackish-brown specimens occur occasionally, the under side being always a little lighter. The variation in color is individual and not influenced by age or difference of sex.

On rare occasions two young are born. We had at least one female in August with two embryos, though in December and January single young were observed. One of them, more than half-grown, was still carried by its mother, as it happens in nearly all bats.

Their flight is rather unsteady, nearly fluttering, as they zigzag between the frayed-out leaves of the bananas, but rarely do they make abrupt turns. They seem to avoid the open places of villages where other bats are most conspicuous.

The distribution of *P. nanus* includes nearly all of the Ethiopian and Malagasy regions. Thus it is among the most widely distributed of African bats, and naturally we found it in both the open and the forested regions.

Sometimes they hide in the thatch of the houses or pursue tiny insects around a lighted lamp; but we found them, together with another form of the orange-rufous *Myotis bocagii,* chiefly in the native gardens. They may take refuge underneath the hanging dry leaves of plantains or wherever they find suitable cover. Their favorite hiding-places are the nearly full-grown bunches of green bananas. They crawl into the darker spaces between the fruits, one or two together. Here they hang in safe and comfortably cool surroundings huddled up in a tiny ball from which the small ears stand out laterally, or cling to the bases of the fruit with thumbs and feet. No wonder that they show special adaptations. The thumb has a large wrinkled callosity and tiny furrows on its under side that by contraction may act as a sucker. Their feet also show similarly wrinkled soles and toes, and thus appear well fitted for crawling and hanging on such smooth surfaces as those of plantains and bananas.

Naturally such a shelter is available only for a short period, hardly exceeding a month, as the plantains become ripe enough to cut down for consumption. Therefore these pipistrelles have no stable household like most of the molossids, which live for decades in the same hollow tree and perhaps for ages in the same rocky cleft, but on the contrary have to keep on the move. From time to time negroes in these regions abandon their villages and plantations, and the pipistrelles in all probability follow. Vagrancy is thus forced upon them and their ubiquitous appearance seems to be merely a consequence of the peculiar conditions offered by the cultivation of plantains and bananas. Though we found them most common in regions where such plantations are numerous, we have no doubt they can adjust their habits to other conditions.

They have hardly any voice, but taken alive and held in the hand these tiny bats snap their mouths open amazingly wide, to an angle of 120°, and what is still more astonishing they keep it in that position apparently without any effort. A comparison with most living carnivora shows that the latter cannot open their mouth, hard as they may try, even to a right angle, only far enough to bite at their victims or to crush bones. Years ago, the sabre-toothed tiger offered to zoölogists the problem, whether its jaw muscles might have permitted the effective use of its gigantic canines in the normal manner. But even so its jaws would never have been farther apart, relatively speaking, than those of many insectivorous bats. With these it is undoubtedly an adaptation merely to increase the gape, so as to facilitate the gathering of insects during flight, just as with the swallows and goatsuckers. Considering the extraordinary sharpness of their teeth, these tiny bats need no specially strong masseters to deal with their habitual prey of insects. The lower jaw in fact is comparatively weak, there is never any long ascending ramus, for that would make it a practical impossibility to open their mouths so wide. A short broadened surface with a rather low coronoid is the general rule for the attachment of the jaw muscles, and the lower part of the mandibular symphysis is often so strengthened that muscles for the lowering of the mandible may act thereon in a special way. The latter features are paralleled to a remarkable degree by the shape of the mandibles of sabre-toothed tigers, but not by other felids.

These tiny bats too often play an unfortunate part in the amusement of black children, who know their haunts so well that to capture one or more of them becomes a passionate sport. With wing membranes torn these bats can move but slowly on the ground; but their readiness to defend themselves with wide-open mouth spurs the youthful tormentors on and makes them capital and entirely inoffensive playthings for youngsters that are to be kept in good humor. Their cruel feelings seem to soar higher and higher as the poor, teased bat becomes more helpless. Not satisfied with merely torturing it in real cannibal fashion, they finally end the troubles of the doomed pipistrelle by spiking it upon a splinter of wood and roasting it alive. Since it is too small to excite the appetite of adults, the children can enjoy the tiny morsels of meat from the breast in unchallenged delight. In this way these savage imps enjoy themselves while their mothers drudge about the plantations in the hot sun.

32. **Pipistrellus abaensis** sp. nov.

The habits and general proportions are so nearly the same as those of *P. nanus* that no repetition is necessary; the fur however is of a lighter brown color. This species undoubtedly represents a paler form from the bushveldt region of the northeastern Uele district. Our experience shows that its variation in color also includes a dark bone-brown phase, which seems to be as common as among a series of *P. nanus.*

It was in the hands of boys that we saw the first fifteen of these bats; among them were two of the darker variety. Since they were all mutilated we asked the children to show us their haunts. They scampered off into a nearby plantation, and by poking in all the bunches of plantains secured six more. Only three could be prepared for our collection; of these one was fortunately of the darker phase.

33. **Pipistrellus musciculus** *Thomas.*

Four years ago Oldfield Thomas when describing this pipistrelle from Bitye, S. Kamerum,[1] said that it was probably the smallest bat yet known. At all events it is smaller than its rather abundant congener, *P. nanus,* for our specimen, an adult female, measures only 2.45 inches (62 mm.) in total length, of which .87 inches (22 mm.) are to be discounted for the tail, and its little wings stretch but 6.4 inches (162 mm.). In length it is thus exceeded half an inch (12 mm.), on the average, by *P. nanus;* and a further distinguishing mark is the lighter color of its pelage, a uniform umber-brown.

In the latter part of February, a period at which even in the Ituri forest there is a spell of dry weather, we were camping in the vicinity of Avakubi beside one of those open muddy areas in the forest, known locally as an "edo," where the elephants and buffaloes come during the rainy season to trample and wallow in the sticky mud. But now the ground had dried out, preserving the deep imprints of gigantic feet; and only a couple of small damp spots remained over which numbers of insects danced and buzzed as we came out of our tent in the early morning. Several times, just as day was beginning to break, we noticed two tiny bats feeding there. Making these spots one end of a swift elliptical course, they snapped at the insects and skimmed off so rapidly as to defy, in this faulty light, either recognition or a successful shot. Then with the increasing day they suddenly vanished.

One morning however as I stood watching, an upward twist carried the bat close to a stout horizontal limb, about 20 feet from the ground, and immediately it was lost to view. Further inspection showed that this bough had a small knot-hole on the under side; so it was cut off and thrown to the ground. A long hollow traversed it. Chopping into this and poking a long switch through it disclosed a hive of tiny black bees (*Trigona*) but no bat, and as they munched this tiny store of honey my men began to assure me that my eyes had deceived me. The search was about to be relinquished when we happened to look again at the knot-hole. Just on the other side in a shallow cavity there crouched this insignificant little creature alive and quite uninjured in spite of its fall. So far as we were then aware it did not differ from *P. nanus,* but our attention was drawn to two bugs (family Cimicidæ) clinging to its wing membranes.

---

[1] Ann. and Mag. Nat. Hist. (8), XI, 1913, p. 316.

34. **Scotozous rüppelii** (*Fischer*).

Creamy white on the under side and mouse-gray above, these are the characteristic colors of this pretty species. The dark obtuse muzzle is nearly hidden in the long fur of the head, from which the slightly elongate but rounded ears stand out laterally. The total length of this male is 3.2 inches (82 mm.), the wings when folded are pale brown, but when fully opened appear nearly transparent and measure 8.25 inches (209 mm.) across.

Like *Scoteinus schlieffenii* it has a large external penis, a half inch long, covered with short white hair directed basally, with a penial bone a quarter of an inch in length; the testes are placed laterally to the tail behind the anus.

Several of these bats were fluttering about the oil palms at Poko on the Bomokandi River, but this male entered a lighted room and could then be easily caught. It was known to occur on the mainland opposite Zanzibar, northward to Egypt and westward to Lake Albert. Its discovery at Poko in the Uele district thus extends its range considerably to the westward.

35. **Eptesicus tenuipinnis** (*Peters*).

A very small brown bat with filmy white wings, actually transparent. Total length, about 2.8 inches (72 mm.), tail 1.14 inches (29 mm.), spread of wings 7.25 inches (184 mm.). Fur of upper surface mummy-brown, sometimes tipped with whitish, that of lower surface dark brown basally, but with whitish ends so that the abdomen appears nearly white. The muzzle is decidedly swollen laterally, and its skin in life is yellowish pink, but whiter just around the nostrils. Ears, wing and tail membranes, as well as claws, metacarpals, and phalanges white; arms and feet dark pink.

Although distributed from Lagos and other parts of West Africa eastward to Lake Victoria, this strikingly colored little bat came to our notice but once, at Ngayu in the Ituri forest. A hollow tree was cut down, in which seven of them were found hanging.

36. **Eptesicus ater** sp. nov.

Similar to the preceding species but darker — fur of the back brownish black — and slightly smaller: total length 2.7 inches (68 mm.), tail 1.15 inches (29 mm.), expanse of wings about 7.15 inches (182 mm.). The wing and tail membranes are of a transparent white, but the ears and face darker than those of *E. tenuipinnis*.

This new species was found just to the north of the forest region, at Niangara and Faradje, and is represented by four specimens. One of these was captured as it circled around under the roof of an open native hut, an hour after nightfall. Another was found in the crop of a hawk, *Machærhamphus anderssoni*, which had been taking its evening toll of bats.

37. **Eptesicus faradjius** sp. nov.

Total length about 3.5 inches (90 mm.), wing-spread 10.5 inches (267 mm.). The long tail, with the pointed interfemoral membrane reaching to its very tip, may sometimes take up even more than two-fifths of the total length. The silky fur on the dorsal side is uniform in color but the individual variation, which has nothing to do with either age or sex, is rather confusing. The reddish-brown specimens show a strong contrast with those of a very faded or dark brown shade. The ventral side is always lighter, especially on the abdomen. The wing and interfemoral membranes are whitish and translucent, though the latter have often a distinct brownish hue in the darker specimens.

We often scared these small bats out from the dense clusters of foliage of either low trees or bushes. In Faradje they clung to the brick walls or to the rafters or even to a single grass stalk hanging from the thatch. There were as many as six together and they preferred the more secluded and darker places. When approached during daylight they were always on the alert and moved quickly out of sight, climbing over the brick walls or deeper into the recesses of the thatch. When disturbed in trees they showed even in the brightest sunlight no bewilderment in the selection of another hiding place.

Like *Taphozous mauritianus*, they were especially numerous in the house and even in native huts right after the beginning of the dry season, when the grass is habitually set afire all over the country. The trees and bushes are then leafless and these bats naturally find a more suitable shelter in human habitations.

Early in the evening they start to pursue their minute prey and usually keep only some five feet from the ground, flying back and forth outside of the houses without fear of human beings, their wings whirring distinctly as they pass. They rarely visit lighted rooms.

They were collected only at Niangara and Faradje and are probably restricted to the bushveldt region north of the tropical rain-forest, especially as we never observed them either near Medje or Avakubi, where we made extensive collections.

38. **Eptesicus minutus minutus** (*Temminck*).

True to its name, a very small species: total length 2.56 inches (65 mm.), tail 1.15 inches (29 mm.), expanse of wings 7.4 inches (188 mm.). Besides rivalling *Pipistrellus nanus* in size, it resembles it in color: fur of back and throat bone-brown, but hair of breast with light buffy tips, which increase in length on the belly, until beneath the tail the hair has become nearly white. Flight membranes brownish-black.

A widely distributed species, extending over a large part of the continent, but represented in our collection by only two specimens, from the northern border of the forested region. At Niangara one was caught after it had flown into a house at night; the other example was shot at Isiro as it flew about in the open, near a dwelling.

39. **Eptesicus garambæ** sp. nov.

Despite its larger size, this new species recalls *Eptesicus minutus* by its brown pelage and brownish black wings. Yet the brown is lighter, for while the fur is deep brownish-black basally, its outer surface on the back is snuff-brown. On the ventral surface the resemblance is closer, the tips of the hair being cartridge-buff. Posteriorly these tips become longer until near the vent the pale color extends to the whole hair. Measurements: total length 3.1 inches (78 mm.), tail 1.27 inches (32 mm.), expanse of wings 8.35 inches (212 mm.).

Our only specimen was collected at Garamba, just on the boundary between the Upper Uele district and the Bahr-el-Ghazal.

40. **Mimetillus moloneyi** (*Thomas*).

The general appearance reminds one very strongly at first glance of a tiny molossid bat. This is due to its short brown fur, rather broad face, and narrow wings; but a closer view destroys the illusion; the tips of the wings do not fold in, there are no spoon-hairs on the toes, and the tail is entirely included in the membrane. The latter is brownish-black, and so are the wings, as far out as the fifth digit, but from there to the tip they are whitish and transparent. Head, body, and tail measure 3.3 inches (84 mm.), the extended wings only 6.85 inches (174 mm.).

Mimetillus moloneyi has smaller wings as compared to the size of head and body than any other bat with which we are acquainted (see Fig. 22). Not only the forearm, but the phalanges especially are extraordinarily shortened. In the original description (Ann. and Mag. Nat. Hist. (6), VII, 1891, p. 529) Mr. Thomas suggested on this account that its manner of life was less aërial, that possibly it climbed about in search of food on trees or rocks. It is nevertheless our opinion that it probably roosts by day in cavities in trees but that its habits do not differ so markedly from those of other bats. Indeed the stomach contents of a specimen shot during flight at Avakubi consisted wholly of remains of small winged termites, as proved by microscopical examination. It was going at a fair speed and very directly but with rapidly beating wings over the open parade-ground. Whether the manner of flight was due simply to the shape and small area of the wings was not quite clear, for this individual was just recovering from two severe wounds on the shoulder and neck, probably inflicted by that relentless foe, *Machœrhamphus anderssoni* (p. 552).

Another example was taken from the stomach of such a hawk, and had undoubtedly been captured on the wing in the usual style, for we had watched the bird, with its mate, in the gathering dusk, as they circled out from a tall dead tree, high over the other tree-tops, returning occasionally to their conspicuous perch.

First described from Lagos, this rare and peculiar bat is an inhabitant of the forest region, as shown by the localities, Stanleyville, Avakubi, and Medje, from which our specimens come. It is not surprising therefore that it has also been collected on the island of Fernando Po.

41. **Scoteinus schlieffenii** (*Peters*).

The presence of this small bat in our collection is due to its ardor in following its small prey close up to a lamp, lighting an open veranda at Niangara.

It is only 3.2 inches (82 mm.) in length and the expanse of the wings is 8 inches (203 mm.). Sepia on the upper side and silky white on the lower surface are the predominant colors. Its stout somewhat short-haired body and the short blunt head give it a slight resemblance in form to a molossid; the broadened dark wings, the tiny laterally projecting ears and the tail, supporting the interfemoral membrane to the very tip, are distinguishing characteristics.

Our specimen is a male. It has a relatively enormous penis, 2 mm. in diameter, clothed with short white hair directed basally and terminating in a pad with a curious escutcheon-like design; the penial bone is 14 mm. in length. Each nostril ends in a smooth slightly projecting pad. Beneath the throat is a small gland opening on the skin by two tiny orifices.

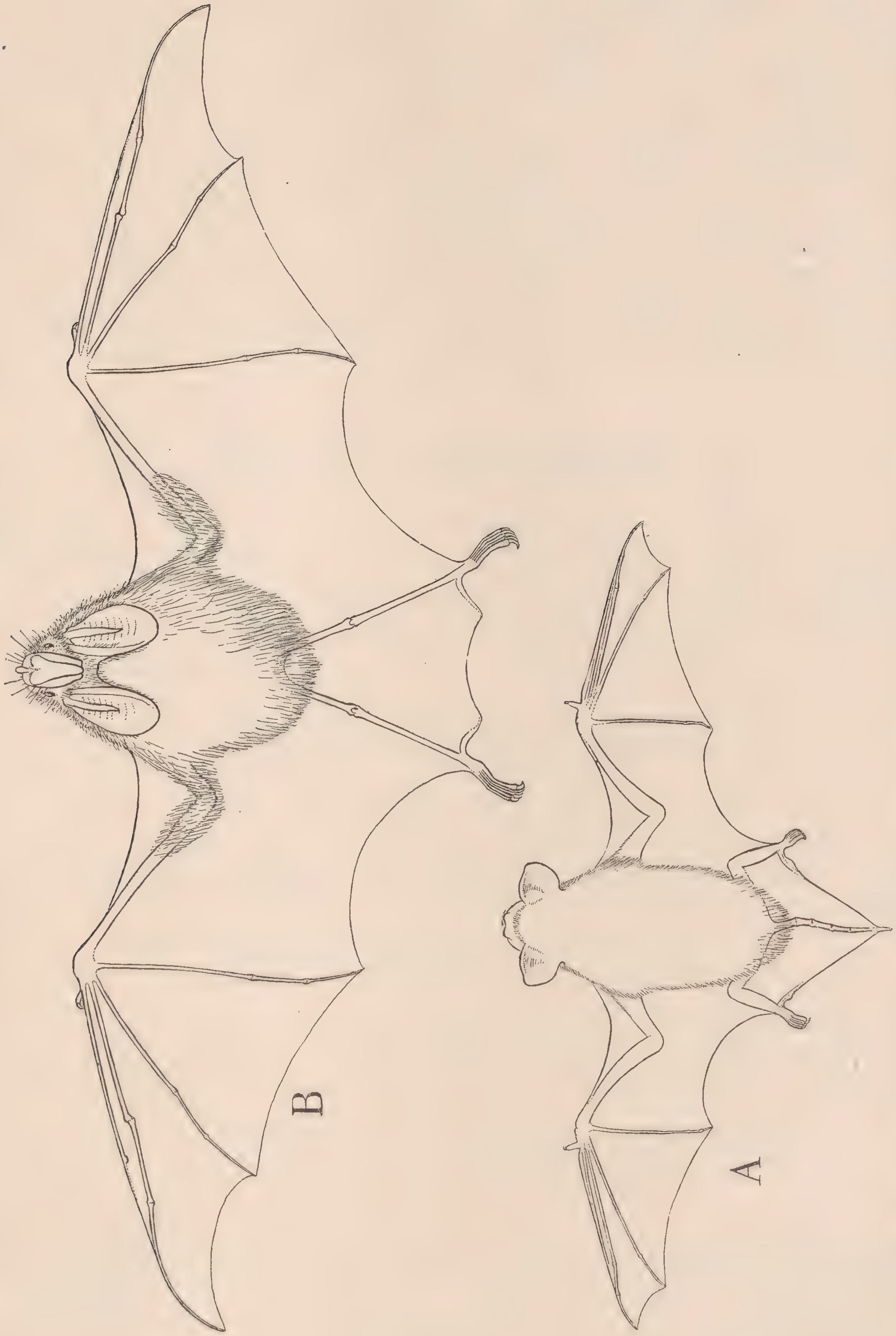


Fig. 22. A. *Mimetillus moloneyi*, $\frac{1}{2}$. B. *Lavia frons affinis*. $\frac{2}{5}$. In these two figures the length of head and body is the same, and the extreme difference in relative wing-area is clearly shown.

42. **Pachyotus altilis** (*G. M. Allen*).

The silky fur of this brown bat is not very long, rather light above and decidedly pale beneath. Its flight membranes are of a much darker brown; the wings spread about 11 inches (279 mm.), while the length inclusive of tail is 4.64 inches (118 mm.).

Known hitherto from the Blue Nile, it ranges into the Uele district, probably to the edge of the forest. Only two specimens, however, were taken by us in March at Faradje, where they were shot as they flew about over the bank of the river at dusk. One of them had two large embryos in its uterus. In the male the scrotal sacs occupy a curious position, close together but posterior to the anus.

43. **Pachyotus nigrita nux** *Thomas.*

This is the largest vespertilionid in our collection; it attains a total length of 4.8 inches (122 mm.). The wings, with a spread of 13.8 inches (350 mm.), are as black as the rounded ears and the muzzle. The rather smooth fur is russet above and ochraceous tawny on the lower side.

The stomach contents showed minute remains of insects, and both specimens had each a large fœtus (March). Natives, who were occupied in felling trees to make the necessary clearing for a plantation, claimed to have taken them in a hollow trunk from which many others escaped. This information is undoubtedly correct, inasmuch as these bats show a rather large pad beneath the thumb indicative of climbing upon hard or rough surfaces.

44. **Glauconycteris papilio** (*Thomas*).

The "butterfly bat" is the prettiest bat we met with in the Congo. Of medium size, it measures 4.05 inches (103 mm.) in length, and its wings extend 12 inches (305 mm.). The dry skins of collections can hardly give an idea of the delicate and charming pattern of their wings. Indeed when alive the curious dark veining is admirably set off by the orange hues of the dull velvety background of wing and interfemoral membranes. The tiny rufous or brown body, much lighter below, and the blunt head attract but little attention. The tail takes up about half of the total length. The females average somewhat larger than the males.

Out of ten females collected in March, two had one fœtus each, but another had two young ready to be born. Their breeding season therefore is perhaps restricted to March and April. The bats and their young could then take refuge in the bushes and low trees newly burst into leaf after the annual fires, which at the beginning of the dry season in December and January had left them perfectly bare.

We found these bats at Faradje during the day hiding in the thatch of abandoned native huts, more than ten huddled in one place, but usually they seem to prefer to conceal themselves between suitable bunches of leaves, as a rule two or three together. Twice we observed in Niangara and Faradje that an overcast sky allowed them to leave their sleeping quarters as early as five o'clock in the evening, when it was still bright daylight. Rather high in the air, sometimes 50 feet from the ground, their ordinary dusky image against the sky gave no hint of their peculiar and strange beauty. They fluttered swiftly, now and then increasing their speed with such spontaneous ease that one hardly noticed the quickened beating of the wings as they gathered their tiny insect prey.

During flight they often utter a curious squeak, as they do, but more angrily, when handled, and like most insectivorous bats open their mouth so wide that in spite of their tiny gape they find no difficulty in biting into the tip of the finger.

We saw these bats only about Niangara, Faradje, and Aba and can state that they are restricted to the more open bush country outside of the equatorial forest.

45. **Glauconycteris humeralis** sp. nov.

Text Fig. 7, *A* (p. 448).

Very different in color from the "butterfly bat" are its dark brown congeners of the Ituri forest. The type of *Glauconycteris humeralis* was one of four specimens all captured together in a bush by a native, while the fifth specimen, a gravid female from Avakubi, was found by a native unable to fly because of an injury to its wing. In length this species measures about 3.25 inches (82 mm.), the expanse of its wings being 9.75 inches (248 mm.).

46. **Glauconycteris alboguttatus** sp. nov.

Text Fig. 7, *B* (p. 448).

Larger than the preceding, with wings spreading 11 inches, this species nevertheless seems to inhabit the same region. Our specimen was procured by a native. For a representation of the color pattern see Fig. 7, p. 448.

47. **Miniopterus breyeri vicinior** subsp. nov.

The fuscous wings are almost matched in color by the fur of the back, that of the lower surface being slightly lighter. The total length is 3.94

inches (100 mm.); tail, 1.89 inches (48 mm.); expanse of wings, 11 inches (280 mm.).

With the exception of a few species of *Pipistrellus*, one may say that the Vespertilionidæ do not rank very high among the bats of the Congo with regard to abundance of individuals, in spite of the considerable number of species. So too, among the many Chiroptera we found living in the rocks near Aba, only one belonged to that family, *Miniopterus breyeri vicinior*. Beyond the fact that they live in colonies in fissures, and that the specimens were procured by smoking them out, little can be said as to their habits.

48. **Miniopterus inflatus** *Thomas.*

We collected this dull-colored bat at Thysville in the only extensive cave we investigated in the Belgian Congo; it had been taken previously at Efulen, over 500 miles northward. Blackish-brown above, it is somewhat lighter below, chiefly on account of the numerous gray hair-tips. Its total length is 4 inches (102 mm.) and the dark wings have a spread of 11.8 inches (300 mm.). The minute nose when greatly magnified resembles the muzzle of a cow in smoothness and in the form of the papillæ, the anterior edge of the lower lip has a hairless pad. Attention may be called to a curious adaptation to their cave life, the folding of their wings when creeping over rocks or when resting. The second phalanges of the third and fourth digits are folded beneath the wing in a peculiar manner (Fig. 24). Their food, according to stomach examinations, consists of rather small insects. They had several interesting forms of parasites (p. 559).

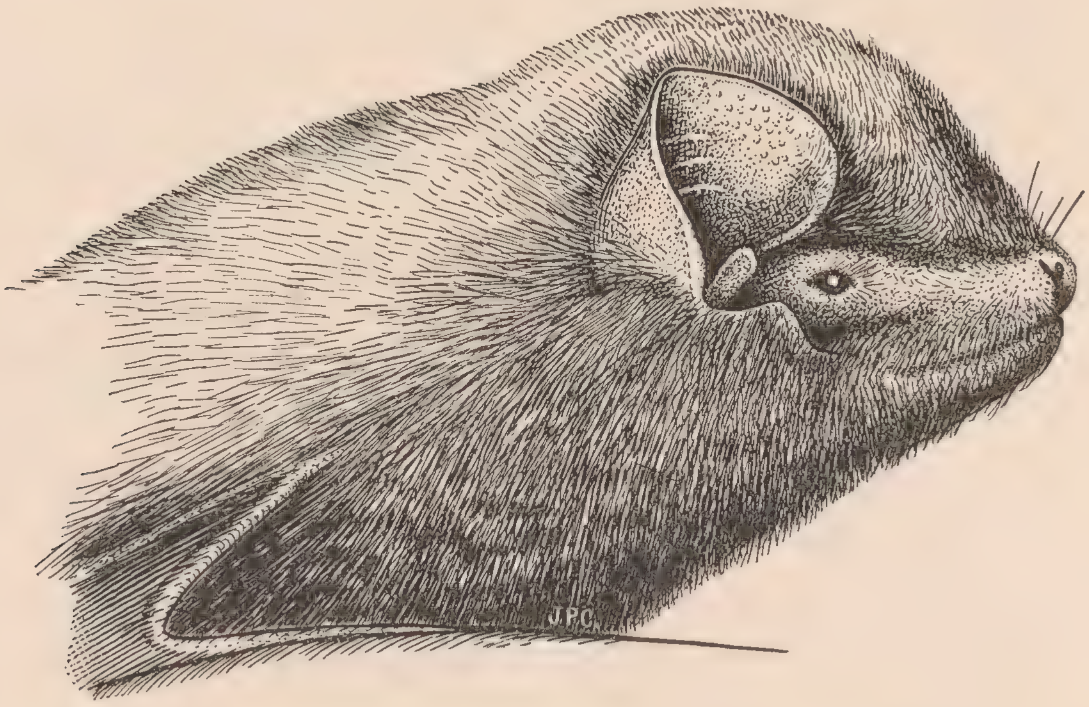


Fig. 23. *Miniopterus inflatus.* Head of male (No. 49334). $\frac{2}{1}$.

A few miles eastward of Thysville among the many grass-covered hills lies the famous bat-cave of the region. Fairy tales have made it the lair of a weird leopard that leaves no traces of his victims. The ever-recurrent rumors of plaintive voices heard from within the cave keep most of the natives at a respectful distance. All these people consider bats choice morsels, yet they would never dare disturb the sanctuary granted by their own superstitions to thousands of bats.

No wonder that our native guides, so enthusiastic at first to show us the hills, suddenly lost heart on hearing that the lanterns they carried would enable us to go inside that very cave. In spite of their hesitation we induced them to show us the hill of our queries, and Dr. Bequaert shared our elation when they finally pointed it out just across a gully.

It looked imposing, and was one of the larger hills belonging to a regular chain. Fairly flat-topped like all the others, with stunted bushes and gnarled trees reaching above the half-dry grass, it rose rather steeply some 400 feet above the valley. We noticed high up on its flanks the more barren patches of limestone that marked the fissures through which the bats and perhaps a few owls found access to the cave. The great entrance however at the foot of the hill was completely masked by a conspicuous patch of dark-green vegetation that thrives well in the moist alluvial soil deposited there by annual floods.

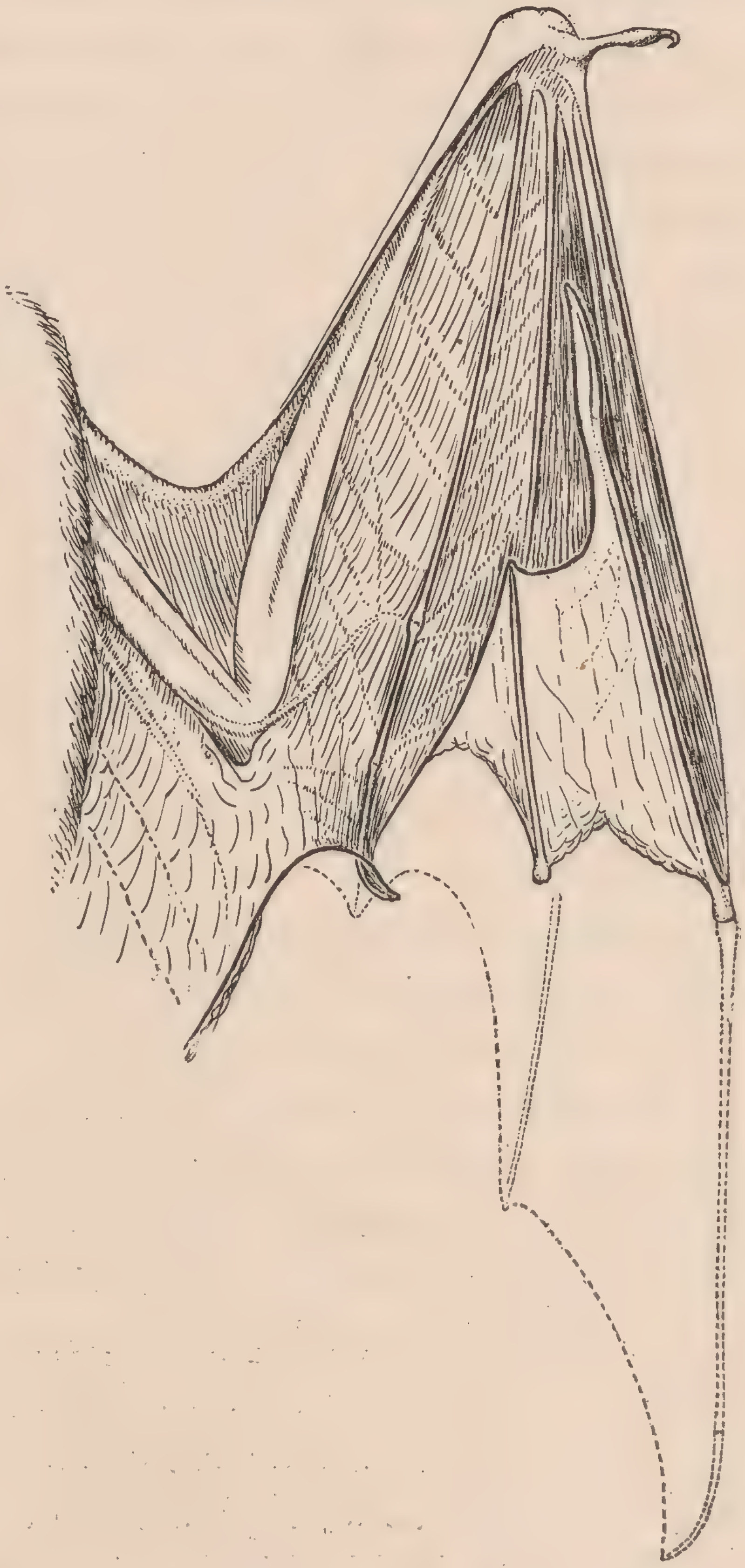


Fig. 24. *Miniopterus inflatus* Thomas. Left wing from below, showing the tip folded. Male, No. 49330. $\frac{4}{3}$.

At this season, in July, the cave was nearly dry and its opening was a jagged tunnel some 15 feet in height and of equal width. A shallow streamlet ran along its whole length, some 700 yards, and proved by its slow progress that the descent was slight. A precipitous shelf marked the end of the accessible part, and the water with but little noise disappeared at once in a chaotic mass of boulders. Sometimes the smooth overhanging walls form large and rugged chambers about 100 feet in height, but everywhere the walls are a dull black. We soon realized that this cave belonged to the bats alone, for there was hardly any room for creatures that could not cling high above its floor. The annual floods would completely close the narrow passages between the obstructing boulders, and inrushing gravel-bearing torrents then scour all the horizontal shelves near the bottom. In spite of the great numbers of bats, only a fine layer of moist guano that exhaled a strong alkaline stench was scattered everywhere, and over it hopped a few pale cave-crickets. We also found a few snails, spiders, and ants, but of species common outside the cave. We had been told of the wonders of this cave, of its remarkable fossils, which proved to be simple erosions, of its great stagnant pools that were however only an inch or two in depth and unsuitable for any aquatic fauna. It was interesting only because of these thousands of bats, even though they all belonged to a single species, *Miniopterus inflatus.*

We had with us two of our old trusted boys, Wawe and Choma-Choma, and proceeded but slowly inside so as to make sure of our way out. Since we were without firearms we wondered how to get the bats; but as the manifold echoes of our voices broke the mystic silence, the cave suddenly became alive. To the great terror of our boys, the "devils" came down upon us. Though the volume of whirring noises was enormous, only a few of the bats encircled our lanterns, like timid scouts who alone dared to inquire into the cause of the unusual disturbance. After catching some with a few lucky strokes of a butterfly net, we were glad to come back again to daylight. Our guides, black messengers of bad omens, cheered up, and we ourselves laughed heartily as we explained to them that according to the white man's superstition we had had bad luck, for we had caught thirteen bats.

49. **Kerivoula cuprosa** *Thomas.*

At first sight this rather rare species resembles *Pipistrellus nanus* though it is somewhat larger, being 3.55 inches (90 mm.) in length, with a spread of wing of 10.85 inches (250 mm.). Above, the dark-brown frizzled hair has pale-brown tips that give it a peculiar golden sheen, but when looked at from another angle appears as though singed. The somewhat lighter under side has also pale-tipped fur. One of its distinctive characters is the fine growth of hair on the skin of the upper surface of the limbs. The toes and thumb are especially well covered, and a few scattered hairs extend to the end of the tail and along the third digit to the tip of the wing.

They do not seem to frequent native plantations but to live in hollow branches, perhaps only in the neighborhood of forest brooks. In fact, a female with a young one, four-fifths her size, was taken when felling some saplings to allow a better crossing for our porters. This species evidently is restricted to the West African rain-forest.

MOLOSSIDÆ.

50. **Myopterus albatus** (*Thomas*).

Plate LIII, Fig. 2.

A large, strangely colored molossid, this bat shows well the distinctive features of the rare genus *Myopterus.* With a total length of 5.25 inches (133 mm.) and the expanse of the transparent wings 14.7 inches (374 mm.), it is only slightly smaller than *Mops congicus.* The tail for two-thirds of its length is involved in the interfemoral membrane. The creamy-white under side contrasts markedly with the brown and buff of the upper side, especially in adult specimens, which show the two typical pale buff stripes dividing the brown color of the back into one narrow median and two broader lateral lines.

When alive *Myopterus albatus* has more erect and pointed ears than species of other African genera of Molossidæ, which have them more depressed and expanding laterally. The whole snout is more cylindrical, the chin is nearly hairless, the lips are rough but not vertically wrinkled, the nostrils do not open on distinct hardened pads, but the nose is smooth and rounded. Below it on the upper lip is an area densely covered with so-called "spoon-hairs." Minute hairs of this kind may be seen in the same position in all the molossids we collected, and they are of regular occurrence on the first and fifth toe in this family. In *Myopterus albatus* they are especially large on the upper lip and always turned upward in the direction of the nostrils, the lower ones being hooked, whereas most of the upper ones bear a spatulate tip. Such a unique tactile broom right in front of the mouth should be more effective than ordinary vibrissæ, and this species could well be called the "brush-lipped" bat (Plate LIII, Fig. 2).

The specimens in our collection were taken from a small colony in a hollow tree at Niangara. The natives first secured five females, and the next day caught two more examples, one of which was a male.

51. **Nyctinomus ansorgei** *Thomas.*

The whole upper side is dark reddish brown of a somewhat singed appearance, as the short hair shows curious light tips. The ventral surface is paler, nearly grayish towards the abdomen, though the throat, especially in adult males, is very dark brown. The total length is 4.45 inches (113 mm.), about one third of which is occupied by the tail. The wing-spread is 13 inches (331 mm.). The wing, at the base of the first digit, has a smooth pad rather large and well adapted for climbing over the rocks. The males showed a well-developed scrotum close to the base of the penis but there were no pregnant females nor did they have any young.

A single bat was taken from a hollow tree near Faradje, all the others are from Piaga, some fifteen miles east of Faradje. Here these bats had established their abode in a long, narrow crack running vertically into the rock of a lone hill which rises some 200 feet in height above the surrounding bushveldt. A layer of dried dung, over a foot in thickness right below the fissure, indicated at once that we had to do with a long-established colony. Such hills offer favorite roosts for many kinds of insectivorous bats.

Some of the more enterprising natives of the nearest Azande village have by common consent assumed the sole right of making periodical raids upon these bats. Since the only entrance is situated on the lower side of the overhanging rock and quite inaccessible, the natives had lashed several poles together to form a rude ladder. Thus they are enabled to stuff heaps of dry grass into the opening, which is only about half a foot wide. When set afire the large amount of smoke produced suffocates the bats by the hundreds and, according to the tales of natives, basketfuls of delicious fatty "birds" are taken home and consumed as a delicacy.

These bats had not been disturbed the day Chapin climbed up the hill. He could distinctly hear them squeaking as they moved about inside the pitch-dark cleft. Wanting only a few, he fired three shots blindly up into the crevice and secured all the specimens in our collection. This naturally caused a babel of squeaking and whirring noises; but not a single bat tried to fly outside, though to judge from the commotion it seemed certainly no exaggeration to estimate their number as several hundred.

This species has hitherto been known only from Malange in northern Angola, where it was collected by Dr. W. J. Ansorge.

52. **Nyctinomus leonis** *Thomas.*

Similar in size and appearance to *N. ochraceus,* but much paler, nearly whitish, below. Only two examples were secured, one at Medje, the other at Panga, on the Aruwimi, but the details of the latter's capture show that in habits it resembles *N. ochraceus* closely. In a swampy forest a couple of miles back of the village a large tree had been found, four feet in diameter, which was hollow from its base upward to a height of 15 yards, with several openings above, but near the ground with only a small hole at one side.

Two large flying-squirrels (*Anomalurus jacksoni*) had already been chased out of this tree by poking a long stick up into it, but since this method no longer produced any effect, we now stuffed burning sticks and leaves into the aperture. For a long time only a little pale blue smoke leaked out above, nothing stirred, and the refuge seemed deserted. At length, however, the inside of the tree took fire, and dense clouds of thick yellowish smoke began to roll upwards. Suddenly a tiny flying-squirrel (*Idiurus macrotis*) made its appearance at one of the upper openings, but withdrew again into the smoke. Soon we discerned another that had already climbed well out on a limb, where it clung against the bark. Had not the tree been nearly bare of foliage we should never have seen it. The smoke was becoming unbearable; the tenants were forced to make a sortie. Three tiny flying squirrels made good their escape by sailing off to shelter in other trees, but four more were secured, as well as two large flying squirrels and this bat, which clambered out on to the bark, but fortunately did not take wing. The only other inhabitant seemed to be a large gecko (*Hemidactylus*).

The tall hollow trunk made an efficient chimney; after a time its whole interior, with a loud roar, burst into flames, which leaped up out of the openings at the top. The hunt was finished. What impressed us most was the amount of smoking these animals could stand before they would venture out into daylight.

These are the farthest eastern records for the species, which was first discovered at Sierra Leone, and later found in the Kamerun and French Congo.

53. **Nyctinomus cisturus** *Thomas.*

Only 3.75 inches (95 mm.) in length, it is chocolate-brown on its upper side and only slightly grayer on the belly. From the fourth digit outward the dark-colored wing membranes are nearly transparent, and the small band of hair across their base on the lower side is pure white and very conspicuous. Alongside the base of the tail below are scattered white hairs. Associated with them are said to be peculiar glands present only in adult males. The hair back of the interaural band is slightly longer but there is no crest.

At Niangara this typical molossid was brought to us by a native who claimed to have caught it when felling a hollow stump. It was formerly recorded only from Mongalla on the White Nile.

54. **Nyctinomus ochraceus**, sp. nov.

The dark rich-brown hair on the upper side, with its silky luster, and the bright orange ventral surface make it a rather conspicuously colored bat, that can thus be easily distinguished. Some specimens, it is true, are slightly paler, but this is individual variation rather than sexual difference. The wings are dark and measure 10.5 inches (266 mm.) across; the total length is 4 inches (102 mm.).

As is generally the case in colonies of molossid bats, the females were the more numerous, and they seem to have a definite breeding season. Among those selected from over a hundred there were only four males, in contrast with eighteen females, fourteen of which had each a single medium-sized embryo in the right side of the uterus. Their full stomachs showed that they had fed upon winged termites, which had been so finely chewed that they formed only a greasy paste with a few chitinous particles from thorax and limbs. Termite wings, which drop off so easily, are apparently rejected.

They have a plump appearance and like most bats of this genus are rather fatty. Since in equatorial regions most of the larger game and even the birds are lean, the natives in spite of the repellent odor exhaled by these bats have so great an appreciation not only for the meat, but especially for the grease which they furnish, that they frequently destroy entire colonies. Very often these bats live in hollow trunks of trees of enormous size or in the hollow portions of their branches. To reach these strongholds, the natives, who could not think of climbing up without assistance, lash light poles one above the other by passing flexible lianas around the trunk. Thus the ascent presents no further difficulty. In this particular case they stuffed dry leaves and sticks into the only exit, some 50 feet from the ground. Setting them on fire they entrapped all the inhabitants, which after much struggling and squeaking fell to the bottom of the hollow.

Sometimes it happens that a tree catches fire inside, but usually the smoke alone suffocates the unfortunate victims. The natives then cut an opening with their axes near the bottom of the cavity and remove the stupefied and partly burned bats.

Such hollow trees are usually inhabited by only a single species of bat, but very often one or more of the five species of flying-squirrels (*Anomalurus jacksoni, A. pusillus, A. beecrofti, Idiurus zenkeri, I. macrotis*) are killed at the same time. Enormous brown roaches also live in the fissures of the decayed wood, and at the bottom of the hole, generally filled with decomposed debris, the natives find very large beetle larvæ, which roasted over the fire are consumed with great delight.

55. **Chærephon frater** sp. nov.

A rather small and pretty mastiff-bat that measures only 3.46 inches (88 mm.) in length, the sharp-pointed transparent wings expanding to 9.7 inches (247 mm.). The chocolate-brown upper side, with a grayish bloom, differs markedly from the ventral side. A great white patch extends from the breast to the vent and then forward over the wing membrane to the armpit as a narrow band of silky white hair. The white, forming thus a W, is interrupted by the dark sides, which fuse with the white-tipped brown hair of the breast and throat. Though distinguished by its much lighter underside it strangely resembles *Chærephon cristatus,* found 25 miles upstream, in the houses at Boma.

It also shows a tiny crest, noticeable in both sexes, but curiously enough much less pronounced in the six males, where it is represented by only a few short dark hairs, than in several of the females (of which we have 16). The latter have a distinct dense patch of coarse, wavy, brown hair just in the center of the back of the membranous skin connecting the ears. This is contrary to what we find in *Chærephon abæ,* where only the males have a crest, and in *Mops osborni* where it is also better developed in that sex.

One evening at Malela, as we watched the numerous palm-swifts that shot back and forth between the great fronds of the few fan-palms near the shore, we saw a bat flying out from underneath the dense entangled masses of dead leaves. Next day a native climbed up, and though he saw several bats clinging close to the trunk, he killed but one. Here, as in so many other instances, the kindly influence of M. Quiton aided us in the enrichment of our collections, so we were enabled to secure 22 specimens.

Chærephon frater, then unknown to science, was found to be the only common bat at Malela, as all our efforts to secure other species proved fruitless. It lived in numbers in that part of the gable of the houses which was generally shut off, clinging in the interstices beside the rafters, several often close together. But as soon as we entered their hiding place they all took wing, making a whirring noise, and many of them sought refuge in the other houses in spite of the bright sunshine. This bat was often observed to fly swiftly between the many narrow lanes of the tall mangrove swamps of that portion of the estuary. Since it seldom frequented the open places over the post, it evidently prefers the wide expanses of water, over the surface of which it skims with great speed; but at times it was seen rather high in the air. The stomach contents show that it feeds on insects without hard integuments.

56. **Chærephon russatus** sp. nov.

Plate LIV.

The warm rufous-brown upper surface of *Chærephon russatus* merges gradually in the lighter, grayer belly. It is only 4 inches (102 mm.) in length, and 11.5 inches (292 mm.) across the outspread wings. In *Mops congicus* it has a perfect counterpart, about one third larger, and very similar in color. Stranger still, the two species were found as room-mates, and as a matter of fact the smaller individuals were declared by natives to be the young of the larger.

Out of 20 females of *C. russatus* examined in September, six had each one fœtus. Both these species are new to science and were taken in the Ituri forest, in the neighborhood of Medje.

Clinging to the rough, decayed surface of the inside of a hollow tree, with their dark wings tucked closely to their plump bodies, these molossid bats look much more like a curiously glistening dark lump of fungus growth than live creatures (Plate LIV).

African molossids generally live together in large numbers, only one species inhabiting the same hollow or cave. As an exception to this rule we once found *Chærephon russatus* and *Mops congicus* forming a large colony in a big hollow tree. Such half-dead giants are often the only reliable witnesses of the height of former forest growth in the neighborhood of villages or in the midst of plantations. They are not considered worth the trouble of felling, as their few stunted branches do not throw the broad shadows that would shut out the sunlight so essential for the successful growth of the one important native staple food, plantains. But as these trees become more and more hollow, many bats attracted by the complete darkness of the sinuous, often labyrinth-like interior find them the most suitable abode in such level forest countries where caves and rocky clefts are rare. They populate them in such numbers that one might speak of hidden bat-cities. From their narrow gates they fly out in even more ghost-like fashion than the bats of temperate climates; because behind the vaporous veil of the damp equatorial atmosphere they disappear instantly. The free-tailed bats indeed are the swiftest in flight, and though several may be seen passing about at one time, each one by itself chases in dexterous swoops the insects it is most fond of, often some two hundred feet from the ground above the dense canopy of the forest, or else lower down about the clearings.

During one of the violent storms that periodically test the stability of such weather-beaten trunks, it happened that the home of an especially large colony not far away from our camp was completely shattered. There we discovered *C. russatus* and *Mops congicus* together. The catastrophe happened in the early afternoon when they all were resting. It seems surprising that in the thundering fall very few bats met their death, but most of them accommodated themselves quickly inside the hollow fragments, from which native children chased them out. Those driven out, when touched, would stop for a moment and lifting their heads would squeak, all the while keeping their mouths wide open and rapidly following the movements of our hand, they were ready to defend themselves with their sharp teeth. But suddenly they might turn, and tails slightly raised, with the help of their folded wings, they would scamper off swiftly on all fours, only to climb quickly into any of the holes or to flatten themselves against the roughened, decayed surfaces of the broken pieces so as hardly to be seen.

They certainly liked to huddle together in great numbers. Those we kept alive in a box were continually crowding into one corner, squeaking and fighting when separated, until as many as six had settled again over each other. We wondered why those below did not suffocate, yet they seemed to feel no inconvenience.

The two species show hardly any difference in their behavior. The photograph (Plate LIV) indicates clearly the peculiar molossid way of resting. Instead of hanging by the feet, extended to nearly their full length, as all the fruit bats and long-haired insectivorous bats (*e. g.*, Nycteridæ and Rhinolophidæ), these short-haired mastiff-bats never hang free, but cling to the surface with both feet and wings. As they can seldom fly directly into the narrow clefts or hollows where they choose to remain during the day they naturally have to creep on all fours for considerable distances. Since they can crawl forward or backward with the same ease, they can enter or back out of the narrowest fissures without any trouble. At the base of the short first digit all molossid bats show a curious hardened pad that assists in this peculiar manner of progression. These pads are more or less developed in different species, and are to be compared with those of *Pipistrellus nanus* (p. 530), but never become such specialized organs as the sucker of the South American genus *Thyroptera.* Those living in the fissures of rocks (*e. g.*, *Nyctinomus ansorgei*) show naturally much larger pads than those habitually frequenting hollow trees, where the surface is softer, such as *Nyctinomus ochraceus, Mops congicus, Chærephon russatus.* So used are they to this mode of creeping that, put on the ground they do not even try to flutter off like other bats, but scurry quickly for the darkest spot in sight. When thrown into the air, however, they fly off easily in spite of the sun, making for any bush or tree and creeping quickly under cover.

When landing on any surface they instantly fold up their wings. The photograph (Plate LIV) reveals well the great assistance they derive from them even in the position of complete rest. As in all other bats, the short first digit of the wing bears a claw, especially sharp in these forms. It can be turned upward, forward, sidewise, and to the rear, in the direction of the other much longer digits that support the flying membranes. Thus they can cling with it to even small roughnesses in any desired position. The toes play an equally interesting rôle on account of the curious structure of their hairs. All these bats when they finally reach their hiding places cling to the surface with feet drawn in and toes widely spread. The first and fifth digits of all the Molossidæ in our collection show a remarkable growth of bristly hairs of unequal length (Fig. 20, p. 556). Most of the longer ones are recurved, nearly hooked at their tips, and grow on the exterior margin of these two toes and about all the claws. The shorter ones are especially numerous on the lower surface of these two toes, sometimes forming dense rows; most of them show a clearly spatulate tip which on superficial inspection gives the impression that they have been singed. These curious hairs have undoubtedly a tactile function, as one might surmise from seeing the bats moving and spreading their toes. Their tiny sharp claws, guided by these tactile brushes, are able to take advantage more rapidly of even the slightest unevenness in rock or wood to which they cling.

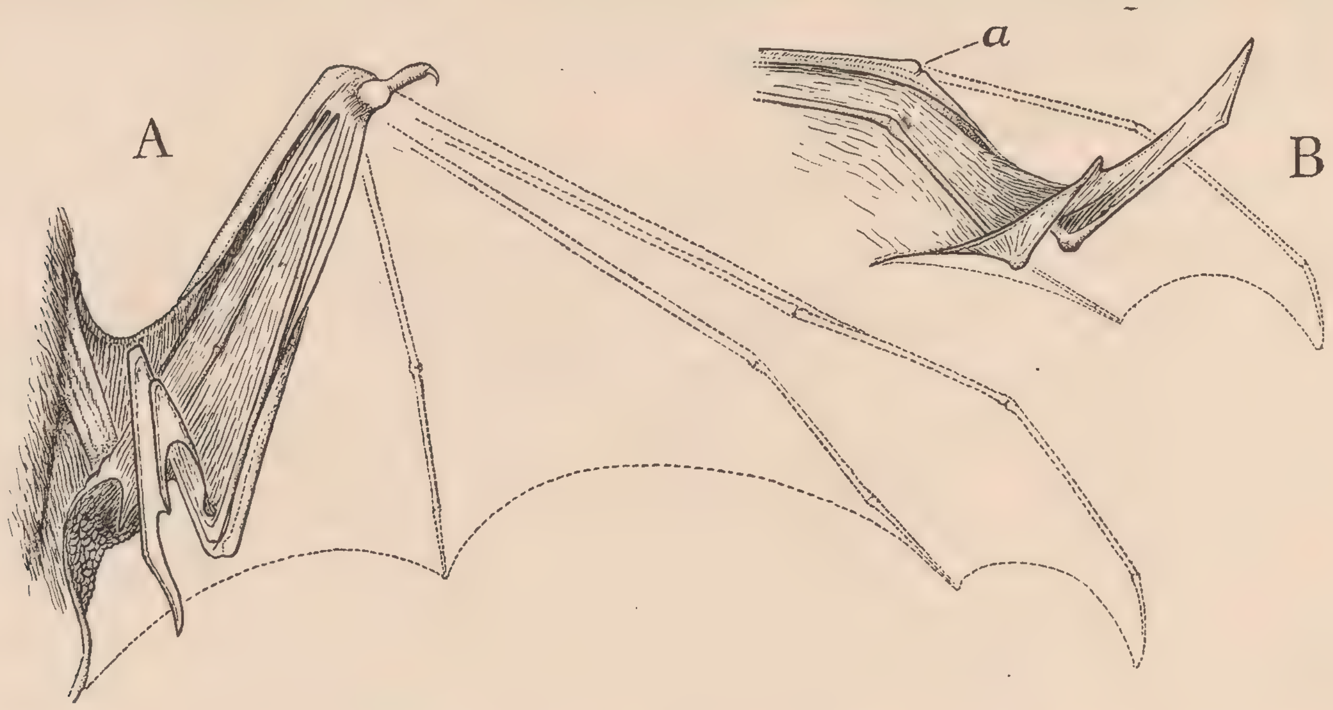


Fig. 25. Wing of *Chærephon russatus*. A. Viewed from below, almost completely folded; extended wing in dotted lines. B. Tip of half-open wing, also from beneath, showing the rotation necessary at *a*, the joint between metacarpal and first phalanx of digit 3, to bring it into position for flight. $\frac{3}{4}$.

We do not think that the function of these spoon-hairs as a comb is very important, though we realize that the short-haired molossids being generally gregarious and living habitually in the very same places for long periods might naturally be infested by the so-called bat-lice (p. 559), yet as a rule they seem to be free from them. We collected nycteribiids only as we happened to notice them in handling the bats, but while we were in a bat cave near Thysville with Dr. Bequaert, who was especially interested in these parasites, we investigated our bats as quickly as they were caught, and secured as many as five bat-lice from a single vespertilionid, *Miniopterus inflatus*, which lived there by the hundreds. From thirteen specimens Dr. Bequaert, who will later publish a special paper on the Nycteribiidæ, could identify three different bat-lice (p. 559).

On the other hand nycteribiids are probably rarer on such long-haired forms as seldom settle in colonies but usually change their abode from day to day. Among the fruit-bats, the gregarious roussette (*Eidolon helvum*) (p. 499) is perhaps more troubled by these parasites than any other bat, and they clean or comb themselves much in the same manner as molossids, but their long toes are bare and without a trace of spoon-hairs. Hanging by one foot, bats scratch or comb themselves with the other with perfect ease all over the belly or about the head and can also reach their backs. Should any parasite be caught even momentarily between such spoon-hairs molossids are certainly adroit enough to dispose of it rapidly.

57. **Chærephon** sp. indet.

Though this specimen is still immature, it is already larger than *Chærephon russatus,* which it resembles in every respect save that it has a much more reddish-brown ventral surface.

It was shot at Avakubi as it circled over the Ituri River, preying on insects.

58. **Chærephon (Lophomops) chapini** sp. nov.

Text Fig. 9 (p. 462).

This small free-tailed bat owes its bizarre appearance to the pretty tuft of long silky hair that decorates the top of its head. Just as in *C. cristatus,* this topknot, attached to the posterior surface of the membrane joining the ears, can be either erected conspicuously or laid back almost out of sight by drawing this fold of skin forward or backward. But in the present species it is far more beautiful; not only are the hairs longer, but while their tips are of a whitish color, their basal portions, forming the center of the crest, are of a rich warm brown. The fur of the body is dull-brown above, and light gray-brown below, the wing membranes filmy white. From nose to tip of tail the length is but 3.3 inches (84 mm.). The only two specimens, both males, are from Faradje; and the species, like *C. cristatus,* inhabits an open district. The forest does not seem to be favored by these tufted bats.

Little can be said of the habits of *C. chapini.* Our first specimen was captured by a black servant in a house at the station, but surely they were not of regular occurrence there, as no other could be secured. The second specimen was taken from the crop of the strange, crepuscular bat-catching hawk, *Machærhamphus anderssoni.* Although darkness had not yet completely closed in, this bird had eaten four small bats, representing as many distinct species, three of which were still unknown to science: *Chærephon chapini, Allomops faradjius, Eptesicus ater* and *Pipistrellus nanus.* In addition to the foregoing, *Nyctinomus ochraceus* and *Mimetillus moloneyi* have been found in the crops of other individuals of these hawks.

A few words about this remarkable bird of prey may not be out of place here, especially as it seems in so many ways adapted just for the capture of bats. Its unusually large yellow eyes suggest at once its nocturnal habits. By day it seldom appears but becomes extremely active at dusk. Falcon-like it pounces upon even the most rapid fliers among bats, striking them, we believe, with its long talons. Its small sharply hooked, laterally compressed bill may help to kill them, and its wide gape of course can dispose of a dead bat at once (Plate LII, Figs. 2 and 3). From our observations we feel inclined to think that it swallows its prey in full flight; and if not softened by the gastric fluids, such bats may make satisfactory specimens. *Machærhamphus anderssoni* is not so rare as generally believed, ranging through tropical Africa to Madagascar. We have seen it all across the Belgian Congo from Boma to Faradje, in open and forest country alike. In color it is brownish-black with faint gray bands on the tail, and a little white on the nape, sides of throat and abdomen. In its general proportions it suggests a peregrine falcon, and though ornithologists have often associated this genus with *Buteo* or *Pernis*, it bears no external resemblance to either of them (Plate LV). Tall bare trees are preferred as perches, but most of the evening seems to be spent on the wing, skimming over the rivers, shooting about the clearings or over the bush country in pursuit of flying prey, or perhaps even coming to raid a colony of nesting weaver-birds.

To say that it preys exclusively on Chiroptera would not be true. Of the nine stomachs examined two were empty, while the others contained a total of eleven bats and ten birds. Half of the latter however were taken from a single hawk. They were bank swallows (*Riparia riparia*), captured as they were flying down the Ituri River to roost in the evening, and swallowed whole, head first. So bats are really the more usual food.

In Africa as elsewhere, stomach examinations of other birds of prey, either nocturnal or diurnal, very rarely disclose bats; indeed they seem to be caught only by accident.

59. **Chærephon (Lophomops) cristatus** sp. nov.

Text Fig. 10 (p. 464).

A small dark-brown bat nearly 3.5 inches (87 mm.) in length, with white-tipped hair below, and pure-white hair along the sides of the body on the inner edges of the wing membranes. The latter are thin and white, but the most striking feature of all is the tuft of brown hair on the posterior surface of the interaural membrane. This topknot is very like that of *C.*

chapini, but the hairs are shorter, and more of one color throughout. Behind it is a bare space, covered of course when the long hair is laid back. Our four specimens being all males, we cannot say whether the females differ, like those of *C. abæ*, in lacking the tuft.

In some of the houses at Boma, including that kindly placed at our disposal by the Belgian authorities, these queer little bats were not uncommon, spending the day singly or at most in twos, in crevices beneath the roofs of verandas, especially where they joined the main concrete wall of the house. They crawled about actively, and were by no means easy to secure. One was captured with a butterfly net as it flew about in a room at night.

60. **Chærephon (Lophomops) abæ** sp. nov.

Text Fig. 11 (p. 465).

At the first glance this dull-colored, medium-sized wrinkle-lipped bat seems to possess no great peculiarities, but closer investigation shows a few points of interest. The remarkable crest of the male is practically hidden, since it grows on the back of a nearly triangular flap filling the gap between the anterior bases of the ears. This membrane is usually turned backward and in the crestless female covers a hairless spot (Text Fig. 11, p. 565). In the male however it can undoubtedly be moved forward so as to show to full advantage the peculiar adornment, a snuff-brown topknot composed of stiff hairs, the longest of which reach 7 mm. in length and radiate from a common center.

This bat attains a total length of 4 inches (102 mm.) and a wing-spread of 12 inches (305 mm.); the upper side is uniform sepia. On the ventral surface the more or less distinct median line and the narrow band on the base of the wing membranes are pure white and rather conspicuous, especially as the rest of the fur is either dark or grayish brown.

Four of these bats were taken in the neighborhood of Faradje in February and March from a hollow tree. The twenty-five others, however, are from rocky clefts of a hill near Aba. They lived in numbers in the dark fissures, their presence being at once betrayed by the curious musty smell. Smoking out the bats by burning grass proved in this case unsuccessful, since the smoke was carried away in another direction. We succeeded better by fastening a leafy branch to a pole and swishing it back and forth between the rocks. A few of the bats fluttered to the ground slightly injured but rapidly crept under cover. More than a hundred were flying to and fro in the dim light of the cleft, and several were caught while dodging about our heads, but none even attempted to fly out into the open or to hide in another cranny. Each bat seemed to be intent on returning to its habitual resting-place. This was apparent, as there were many crevices, and when we stirred them from their refuge they would shoot out, but returned at once to the very same fissure as soon as we stopped annoying them.

It is rather surprising that only two males were found among the thirty specimens of this collection and among the many others caught by natives at the same time. This new species is probably restricted to the open country outside the rain-forests.

61. **Mops midas** (*Sundevall*).

All the specimens were collected at Faradje during March, when the water of the river was lowest. In fact these bats were only seen during a short period. One of the largest of all the wrinkle-lipped bats, it measures 5.3 inches (135 mm.) in length, with the dark wings spreading about 18.5 (469 mm.). Its colors are rather indistinct; the white tips of the brown hair on the back give a peculiar silky bloom, which predominates on the much lighter ventral side. Its ears are very broad and are joined across the forehead by a membrane, but there is no trace of a crest.

During the latter part of the dry season, every evening about dusk, a dozen or so of these fast fliers appeared some 50 or 100 feet above the Dungu River and over the open place of the post. Their favorite sport was to dodge and dive after small hard-shelled Coleoptera, which were then common. We greatly admired their speed, but their success and cleverness in catching insects and the rapidity with which they masticated these tiny beetles in full flight was proved through the microscopical evidence of the stomach contents from specimens shot on the wing.

There are no rocky cliffs in the neighborhood of Faradje, and it is probable that *Mops midas* has its abode in the hollows of large trees along the river. This would be in accordance with Glover M. Allen's remarks. Its known range would prove it a species characteristic of the more open country, since it is recorded from Faradje in the northeastern Uele, across the White Nile to Fazogli on the Abyssinian frontier, a distance of about 600 miles.

62. **Mops congicus** sp. nov.

Plate LV.

One of the largest of its genus, measuring 5.5 inches (140 mm.) in length, with a wing spread of 16.5 inches (420 mm.). Its color is very similar to that of *Chærephon russatus* but darker. Together with that species it was found living in a hollow tree near Medje, as described on page 547 ff. Five females out of twelve had each one large embryo (in September).

63. **Mops niangaræ** sp. nov.

Compared with *Mops midas,* which it nearly equals in size, this species shows very definite external characteristics. Its relatively small ears do not join across the forehead; but it can boast of a crown that starts from the short-haired nape and, becoming gradually longer, stops abruptly where the interaural membrane would be in related species, some of which, as *Chærephon* (*Lophomops*) *chapini,* bear an erectile crest on the back of this movable skin (p. 462).

The upper side is hazel-brown, the under side buffy brownish with a yellowish tinge on the breast and on the lower side of the neck. It attains a length of 4.9 inches (125 mm.), the dark wings have an expanse of 16.8 inches (426 mm.).

It is one of the many species that live in hollow trees and probably will be found to occur elsewhere in the more open country of the northern Uele.

64. **Mops trevori** sp. nov.

Plate XLVIII, Fig. 2.

At Faradje in September, half a dozen of these bats flew back and forth so rapidly that we thought shooting one in the dim moonlight more difficult than securing some of the fast-flying swifts and almost impossible. But challenged thus, Chapin brought down one which has proved to be new to science. Only a little smaller than *Mops midas,* it has a length of 4.15 inches (105 mm.) with a wing-spread of 15.1 inches (384 mm.). Above it is chestnut-brown with a distinct bloom; below a light grayish brown tint is predominant, with white hairs especially numerous on throat and breast. Behind the aural membrane it has a crest of coarse, slightly curved hair growing in bunches, but the surrounding ordinary hair is also considerably lengthened. Its stomach contents showed that it fed on good-sized Coleoptera. It also had a very large embryo.

65. **Mops** (**Allomops**) **osborni** sp. nov.

Text Figs. 12–14 (pp. 470 ff.) and 26.

Between the species of Molossidæ with a large tuft of hair on the back of the interaural membrane, like *Chærephon* (*Lophomops*) *chapini,* and those that lack it completely, there are several intermediate forms, including the present, where there is a distinct but short dark brown tuft more pronounced in the male (Fig. 14). The hairs moreover are here gathered into many little bunches, whereas in *C. chapini* they grow singly.

Mops osborni is larger than the other crested representatives of the family; total length 4.4 inches (111 mm.); tail 1.5 inches (38 mm.); expanse of wings 13.4 inches (340 mm.). Its colors are dull, the flight membranes grayish-brown, the fur of the upper side hair-brown with a sprinkling of gray hairs, the middle of the belly grayish-white, the rest of the lower side having the hair brown with grayish tips. The most important character is internal: a very high sagittal crest on the skull of the male.

Bats in the Congo, however abundant, seldom trouble one's sleep, for those that frequent dwellings are generally small and quiet. In all Africa of course there are none that suck blood like the vampires (Desmodontidæ) of South America. In the Upper Congo even European architecture becomes decidedly simple. Aeration being a prime requisite there is often no ceiling below the roof of grass or *Phrynium* leaves; the whole interior is open. Occasionally such a house when closed for a long period becomes the domicile of a flock of bats; but open the windows wide, admit the light and air, and they depart for good.

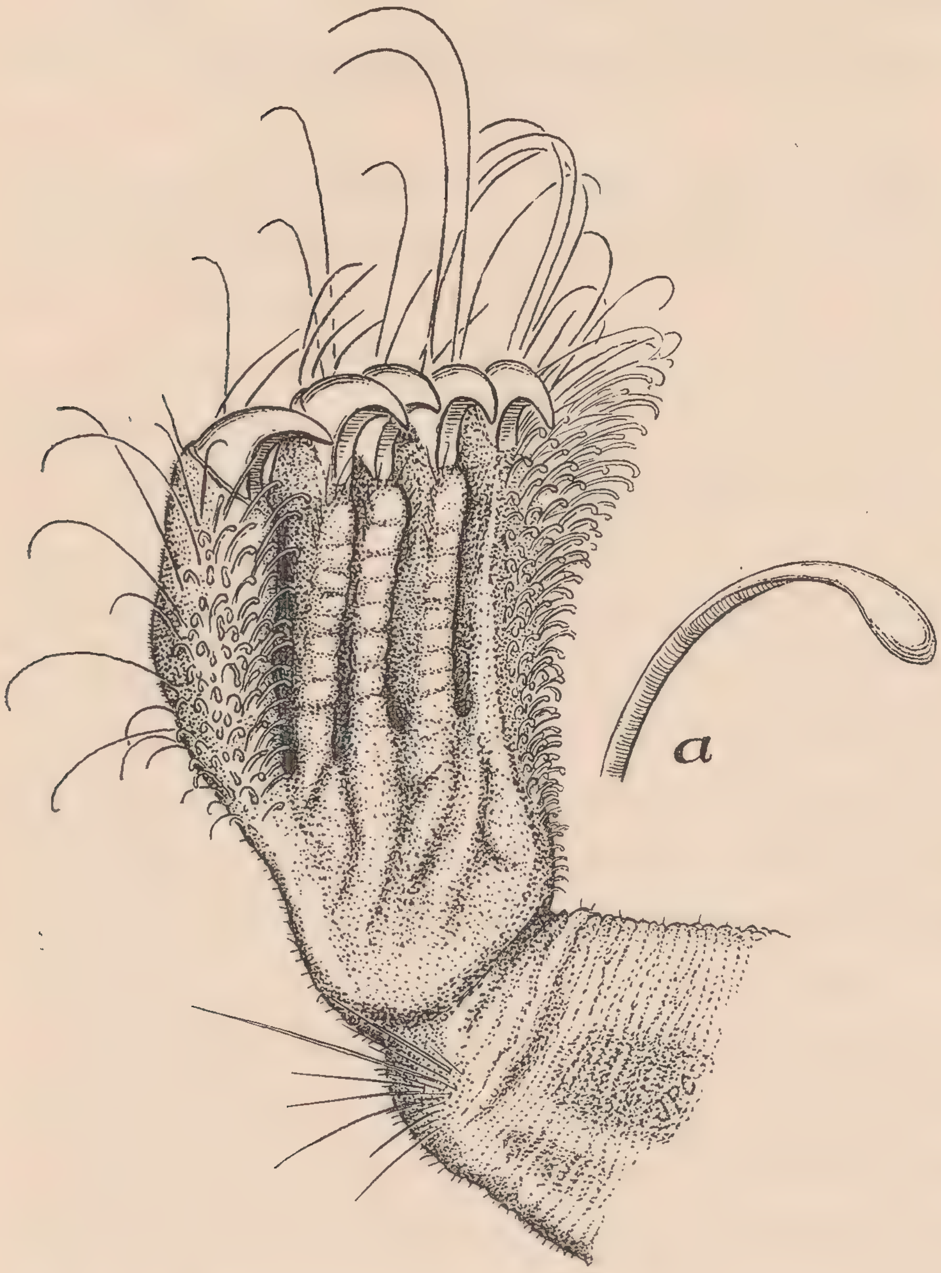


Fig. 26. *Mops (Allomops) osborni*, sp. nov. Right foot (type), from below, to show spoon hairs on first and fifth digits ($\frac{4}{1}$). *a*, spoon hair enlarged ($\frac{24}{1}$).

More advanced methods of building, however, often prevail in the more accessible parts of the colony, and these dwellings with their many remote, dark, or unused portions are frequently chosen as a congenial refuge by Chiroptera. A small house, for instance, in which we lodged at Kinshasa, built most comfortably of wood and sheet metal, was provided with a double roof, the space between being ventilated through holes under the eaves, which served at the same time as doorways for a large community of molossid bats. Occasional scufflings and squeaks betrayed their retreat, and all the rooms had that peculiar smell noticed beneath the hill at Piaga, where an old-established colony of *Nyctinomus ansorgei* occupied a narrow vertical cleft.

Under ordinary conditions it would have been difficult to obtain any specimens; but efforts were being made to dislodge them, by removing sections of the roof; and one day as I stood on the porch, down tumbled two bats. Sprawling on the ground, they were seized before they could climb anywhere to take wing, though they protested vigorously with their sharp teeth. Fortunately they proved to be male and female of a species new to science, *Mops osborni*.

66. **Mops (Allomops) occipitalis** sp. nov.

Text Fig. 15 (p. 475).

When alive and moving this bat recalls at first *Nyctinomus ochraceus*, as they both have, on the upper side at least, the same dark, rich brown gloss due to their peculiar smooth and soft appearance. But in *Mops* (*Allomops*) *occipitalis* the short hair on the back is restricted to a narrow tract. Where this stops near the base of the hind limbs it ends on either side in a few long hairs, as in many other bats of this genus. Back of the membranous skin uniting the ears the fur is also distinctly longer but forms no crest. Though the flanks are nearly black, the belly is much lighter, either reddish- or buffy-brown. The upper lips are only slightly wrinkled and bear very minute upturned bristles and spoon-hairs. Of medium size, it measures but 4 inches (101 mm.) in length, the dark wings spreading about 10.7 inches (272 mm.).

It lives in hollow trees, and since it was collected only at Medje and Avakubi it may be considered typical of the forest region. The males are exceptionally well represented by seven specimens, whereas among other series of this family females always predominate.

67. **Mops (Allomops) faradjius** sp. nov.

A medium-sized wrinkle-lipped bat of 4.25 inches (108 mm.) in length with the expanse of its dark wings about 12 inches (305 mm.). Since the dark-brown upper side is tipped with gray, it is not so hoary in appearance as the white-tipped back of the larger *Mops midas*. As in *Mops* (*Allomops*) *occipitalis* the hair, short on the nape, becomes somewhat longer before reaching the membranous skin uniting the ears, but there is no real crest. The dark sides of the neck blend into the nearly white ventral surface, though the sides are strongly suffused with gray. The narrow band on the under side of the wing membrane near its inner edge is also white.

Birds of prey sometimes give indirect information to naturalists as to the smaller fauna of a region. The examination of owl pellets, for instance, has often revealed skulls or portions of rodents or small insectivores not previously known to occur there. Few however can claim to have killed a hawk and taken out of its crop, in good condition, four species of bats, three of which were new to science. Yet such was the luck of Chapin at Faradje when he bagged one of the interesting bat-catching hawks, *Machærhamphus anderssonni* (p. 551). Several days previously he had noticed this hawk, but thinking first of an owl, since scarcely any other bird of prey could be active at so late an hour, he was surprised later to recognize this crepuscular hawk. Flying up and down the Dungu River it collected its victims from among the bats that kept close to the surface of the water. *Mops* (*Allomops*) *faradjius* is one of the bats thus discovered and this specimen remains unique, as no other could be secured. We already knew of this hawk and its habits but confess that we little expected thus to be aided in securing species still unknown.

68. **Mops (Allomops) nanulus** sp. nov.

Among the nineteen species of molossids we collected, this is by far the smallest. It attains only a length of 3.1 inches (78 mm.), the wingspread of the dark though slightly transparent wings is 8.75 inches (222 mm.). The general color is dark or rufous brown above, but the under side is much lighter, the neck and a median tract of the belly being usually grayish buff.

Several evenings before their capture these tiny bats were observed to alight, as it seemed, in a cluster of epiphytic ferns (*Asplenium*) growing high up on a trunk; but a closer investigation by daylight proved that these plants only concealed the entrance to a cavity. Some burning splinters of wood were pushed down into the narrow entrance, but our efforts to smoke them out proved a complete failure. Before darkness set in some of these little bats were seen to fly out again from the hole in the tree. They evidently did not hunt in the neighborhood since they were not noticed again. We decided to have a hole cut at the base of the cavity, but though two men chopped away during the better part of the day, only towards evening did the hollow portion become accessible. Two bats managed to escape quickly and the natives, discouraged, gave up the task. We asked them however to try fire again before leaving, and were soon gratified to secure seven specimens, which have proved to be of a species previously unknown to science.

REMARKS ON PARASITES OF AFRICAN BATS.

In describing the life-histories of African bats it would be a mistake to pass over in silence their interesting insect parasites, especially as these are so apt to be neglected by the mammalogist, in spite of their evident ecological interest. We feel justified therefore in adding a few notes of a general character on this subject, largely provided by Dr. Joseph Bequaert, who speaks from personal experience in the Congo.

Among the various parasites collected on bats by the Congo Expedition, the most curious in appearance are probably the Nycteribiidæ, often called in English bat-lice or bat-ticks. They are however true Diptera, though wingless, pupiparous, blood-sucking parasites. In the adult stage they rarely leave their host.

The following species were collected:

Tripselia fryeri Scott	on *Saccolaimus peli.*
Cyclopodia greeffi Karsch	on *Eidolon helvum.*
Penicillidia senegalensis Gervais	on *Hipposideros caffer centralis*
Penicillidia fulvida Bigot	on *Miniopterus inflatus.*
Listropoda schmidlii Schin.	on " "

The largest of these parasitic flies is *Cyclopodia greeffi* Karsch, which may attain a length of 3 to 4 mm. Its life-history has recently been studied by J. Rodhain and J. Bequaert.[1] It is so common in the Belgian Congo that we rarely found specimens of *Eidolon helvum* without one or more of these parasites. When the host is handled they attract attention by quickly scurrying across the fur, and their spider-like form then becomes noticeable as they try dexterously to conceal themselves somewhere else in the fur with their long legs armed with curved claws. Even after the death of their host, which may have been carried along for hours, or even preserved in alcohol, a few nycteribiids may still be found clinging to the hair. According to Rodhain and Bequaert's observations this parasitic fly lays no eggs, but the young develops inside the body of the female. When the larva is full grown, the pregnant female fly leaves the bat and deposits its larva on some object near the sleeping-place of the host (wood, rocks, leaves, etc.). This larva changes directly into a pupa, and after 12 to 16 days the adult emerges in a wingless state; it has then to search for a new host or otherwise perishes rapidly.

The other nycteribiids probably have similar habits, although very little is known on that subject.

A very interesting winged parasitic fly, *Brachytarsina flavipennis* Macquart, was found on *Miniopterus inflatus;* it belongs to the Streblidæ, a family closely related to the Nycteribiidæ. But little is known of their reproductive habits, though it is believed that they are also pupiparous.

---

[1] Observations sur la biologie de *Cyclopodia greeffii* Karsch. Bull. Soc. Zool. de France, XL, 1916, pp. 248–262.

Buried in the skin of bats are sometimes found maggot-like parasites, of a curious flask-shape, which are really adult flies. They have been described under the generic name *Ascodipteron,* and were even separated as a distinct family, the Ascodipteridæ. Recently it has been proved that *Ascodipteron* is only a stage in the adult life of a streblid. On emerging from the pupa the fly has legs, wings, and a large proboscis; the females however soon pierce the skin of a bat and bury themselves deeply within, at the same time losing legs and wings and altering the rest of their external form. These curious insects are pupiparous (or better, larviparous) like the Nycteribiidæ; the orifice through which the adult larva is released opens through the skin of the bat. Several species of *Ascodipteron* have been described,[1] and they are curious examples, in their life-history, of what is called "postimaginal development," the changing of the form and the tissues after the last molt (Dr. J. Bequaert). The integuments in which *Ascodipteron* is usually found are at the base of the ear and on the wing; we found them on *Hipposideros caffer centralis* as well as on one or two other bats from caves at Aba.

The two bugs found on *Pipistrellus musciculus* (p. 553) belong to the family Cimicidæ, the same that includes the common bed-bug. Several genera live as parasites on bats, but these particular specimens have not yet been identified.

EXPLANATION OF PLATES XLIV–LV.

Plate XLIV (in color).

Heads of males.

Fig. 1. *Epomophorus anurus* Heuglin. $\frac{3}{4}$.
Fig. 2. *Epomops franqueti franqueti* (Tomes). $\frac{3}{4}$.
Fig. 3. *Eidolon helvum* (Kerr). $\frac{3}{4}$.
Fig. 4. *Hypsignathus monstrosus* H. Allen. $\frac{3}{4}$.
Sketched from freshly killed specimens by J. P. Chapin.

Plate XLV.

Fig. 1. *Epomops franqueti franqueti* (Tomes). Head of adult male, No. 49196, Niapu, December, 1913.

Fig. 2. *Epomops franqueti franqueti* (Tomes). Head of a very young female, No. 48718, Medje, Sept. 12, 1910.

This and the following plates from photographs by H. Lang.

---

[1] For a very complete account see F. Muir, Bulletin of the Museum of Comparative Zoölogy, LIV, 1912, p. 351.

PLATE XLVI.

Epomophorus anurus Heuglin. Female, No. 48749, Faradje, Dec. 1, 1912.

PLATE XLVII.

Epomophorus anurus Heuglin. Female, No. 48749.

PLATE XLVIII.

Fig. 1. *Taphozous mauritianus* Geoffroy. Female, No. 48798, Faradje.
Fig. 2. *Mops trevori* sp. nov. Female, No. 49250, Faradje, September, 1912.

PLATE XLIX.

Saccolaimus peli (Temminck). Female, No. 48768, Niangara, May 27, 1913. Two views of head.

PLATE L.

Lavia frons affinis Andersen and Wroughton. Female, No. 49072, Faradje, April 23, 1911. Front and side views of head.

PLATE LI.

Fig. 1. *Hipposideros gigas niangaræ* subsp. nov. Female, No. 49103, Niangara, May 30, 1913. Front view of head.

Fig. 2. *Rhinolophus axillaris* sp. nov. Male, No. 49132, Aba, December 17, 1911.

PLATE LII.

Fig. 1. *Hipposideros caffer centralis* Anderson, male, No. 49110, Leopoldville, July 9, 1909.

Fig. 2. Head of bat-catching hawk, *Machærhamphus anderssoni*, Field No. 4468, male, Faradje, Jan. 12, 1913. About $\frac{1}{2}$.

Fig. 3. Outline of bill, from above, same specimen.

PLATE LIII.

Fig. 1. Head of *Chærephon* (*Lophomops*) *cristatus* sp. nov. Male, Boma, June 15, 1915. $\frac{2}{1}$.

Fig. 2. Head of *Myopterus albatus* Thomas. Female, No. 49228, Niangara, Dec. 27, 1910. Note the dense patch of spoon-hairs on upper lip. $\frac{2}{1}$.

PLATE LIV.

Photograph of three specimens of *Mops congicus* (at left), and of four specimens of *Chærephon russatus* (three at right and one above the middle), showing position and appearance when suspended at rest.

PLATE LV.

Bat-catching hawk (*Machærhamphus anderssoni*), pursuing a molossid bat (*Mops faradjius*), the largest species which was found in its crop. $\frac{1}{6}$.

TEXT FIGURES.

Map of the Congo and Lake Region of Africa, showing all the localities where bats were collected by the Congo Expedition, as well as others mentioned in the present paper. The limits of the West African rain-forest are indicated by a broken line . . . . p. 415

Fig. 1. Outline drawings showing how the ear was measured by the collectors. *A, Saccolaimus peli* ($\frac{1}{1}$); *B, Eidolon helvum* ($\frac{2}{3}$) . . . . p. 407

Fig. 2. *Hypsignathus monstrosus.* Direct front view of head, adult male, from a freshly killed specimen. $\frac{1}{1}$ . . . . p. 419

Fig. 3. *Nycteris avakubia.* Head, from field sketch of type, No. 49403, male. $\frac{4}{3}$ . . . . p. 426

Fig. 4. *Hipposideros langi.* Head of adult male (No. 49391), showing nose-leaves and frontal sac. $\frac{2}{1}$ . . . . p. 435

Fig. 5. *Hipposideros langi.* Pubic region of female (No. 49389). $\frac{1}{1}$. p. 436

Fig. 6. *Hipposideros langi* sp. nov. Pubic region of male (No. 49391). *A*, anal sac invaginated; *B*, anal sac everted. $\frac{1}{1}$ . . . . p. 437

Fig. 7. Sketches of (*A*) *Glauconycteris humeralis* sp. nov., male (No. 49315), and (*B*) *G. alboguttatus* sp. nov., type, female (No. 49317), to show white markings of shoulders and back. $\frac{1}{1}$ . . . . p. 448

Fig. 8. *Kerivoula cuprosa* Thomas. Skull of adult female (No. 49336). $\frac{3}{1}$. p. 452

Fig. 9. *Chærephon* (*Lophomops*) *chapini* sp. nov. Adult male (type, No. 48841). *A*, side view of head, crest erect; *B*, view of crown, crest erect; *C*, same view, crest laid back. All $\frac{3}{2}$ . . . . p. 462

Fig. 10. *Chærephon* (*Lophomops*) *cristatus* sp. nov. Adult male (No. 49259). *A*, crest erect; *B*, crest laid back. All $\frac{3}{2}$ . . . . p. 464

Fig. 11. *Chærephon* (*Lophomops*) *abæ* sp. nov. *A*, crown view of head, male; *B*, crown of head, female. $\frac{3}{2}$ . . . . p. 465

Fig. 12. *Mops* (*Allomops*) *osborni* sp. nov. Skull of type, adult male, No. 49230. $\frac{2}{1}$ . . . . p. 470

Fig. 13. *Mops* (*Allomops*) *osborni* sp. nov. Skull of adult female, No. 49244. $\frac{2}{1}$ . . . . p. 471

Fig. 14. *Mops* (*Allomops*) *osborni* sp. nov. Crown of male type, to show the small crest on back of frontal membrane. $\frac{3}{2}$ . . . . p. 473

Fig. 15. *Mops* (*Allomops*) *occipitalis* sp. nov. Skull of adult male type (No. 48851). $\frac{2}{1}$ . . . . p. 475

Fig. 16. *Hypsignathus monstrosus.* Tongue of adult male (No. 48657), viewed from above. $\frac{2}{1}$. Characteristic form in life, when extended. *con.*, conical; *cv.*, circumvallate; *fi.*, filiform; *fo.*, foliaceous; *trid.*, tridentate papillæ. . . p. 485

Fig. 17. Interfemoral membranes. *A*. Rhinopomidæ (*Rhinopoma microphyllum*), from beneath; *B*. Emballonuridæ (*Taphozous mauritianus*), from above; *C*. Nycteridæ (*Nycteris arge*), from below; *D*. Molossidæ (*Nyctinomus ansorgei*), from above. All $\frac{3}{4}$. For interfemoral membrane of Megadermidæ, see Fig. 22; of Rhinolophidæ, Figs. 5 and 6; of Vespertilionidæ, Figs. 7 and 22 . . . . p. 495

Fig. 18. *Hypsignathus monstrosus.* Head of adult male (No. 48657). The heavy broken line indicates extent of cheek-pouch. $\frac{3}{4}$ . . . . . p. 503

Fig. 19. *Hypsignathus monstrosus.* Adult male (No. 48657). Dissection from ventral side, showing pharyngeal sacs, hyoid bones, larynx, and general arrangement of viscera. *cric.*, cricoid cartilage of the larynx; *crico-th.*, crico-thyroid muscle; *d. 1, 2, 3, 4, 5*, first to fifth digits; *genio-hy.*, genio-hyoid muscle; *hyo-gl.*, hyoglossus muscle; *mylo-hy.*, mylo-hyoid muscle; *obl. ext.*, external oblique muscle of the abdomen; *obl. int.*, internal oblique muscle; *occ. poll.*, occipito-pollicalis muscle; *or. ph. s.*, orifice of pharyngeal sac, communicating with nasopharynx; *pect. maj.*, pectoralis major; *pect. qu.*, pectoralis quartus; *phar. sac*, left pharyngeal sac; *st. hy.*, sterno-hyoid muscle; *st. mast.*, sterno-mastoid muscle; *thyr.*, thyroid cartilage of larynx. $\frac{2}{3}$ . . . . p. 506

Fig. 20. *Hypsignathus monstrosus.* Sagittal section of adult male (No. 48655), showing pharynx, vocal organs, and viscera. $\frac{2}{3}$ . . . . . . p. 507

Fig. 21. *Saccolaimus peli.* Wing from above, to show folding of the tip (wing with tip extended shown by dotted line). $\frac{1}{2}$ . . . . p. 515

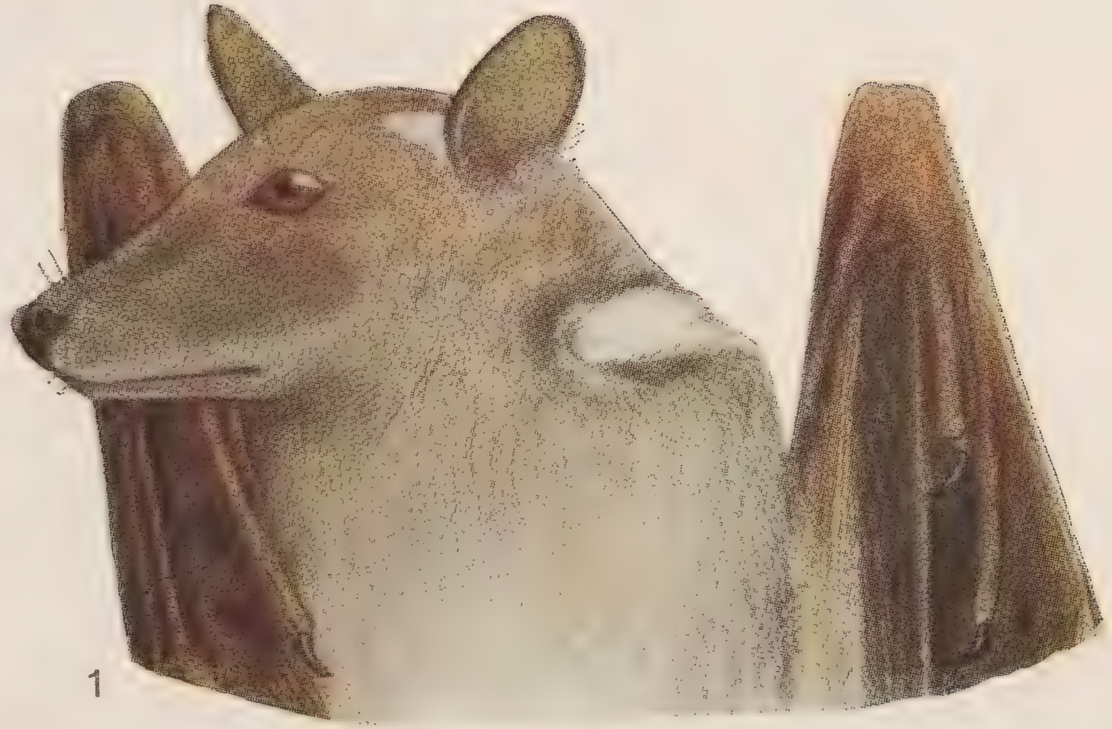
Fig. 22. A. *Mimetillus moloneyi.* $\frac{1}{2}$. B. *Lavia frons affinis.* $\frac{2}{5}$. In these two figures the length of head and body is the same, and the extreme difference in relative wing-area is clearly shown . . . . p. 537

Fig. 23. *Miniopterus inflatus.* Head of male (No. 49334). $\frac{2}{1}$ . . p. 540

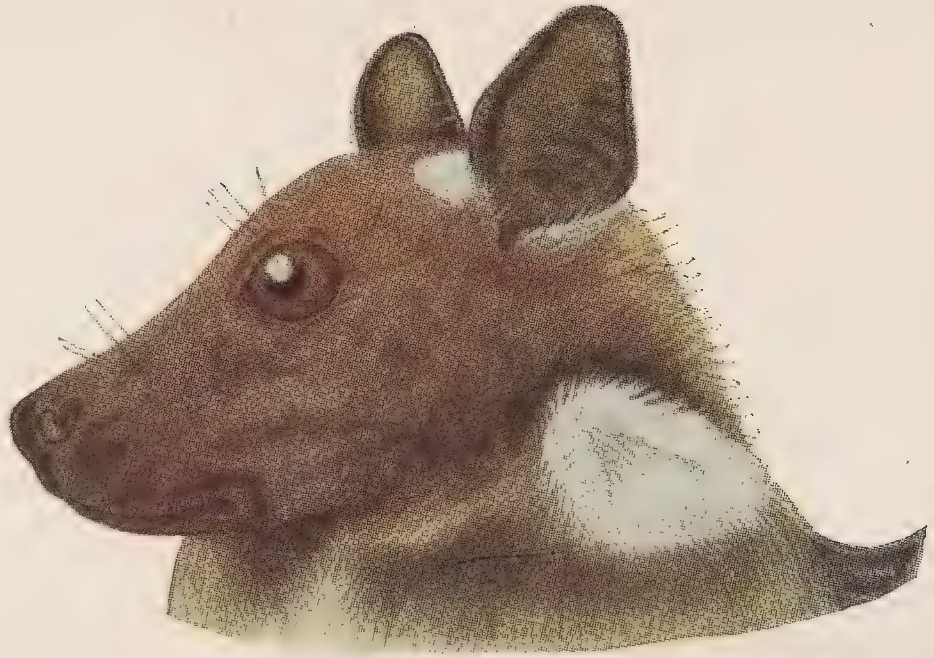
Fig. 24. *Miniopterus inflatus* Thomas. Left wing from below, showing the tip folded. Male, No. 49330. $\frac{4}{3}$ . . . . p. 541

Fig. 25. *Chærephon russatus* sp. nov., to show folding of the tip of the wing. $\frac{3}{4}$. p. 550

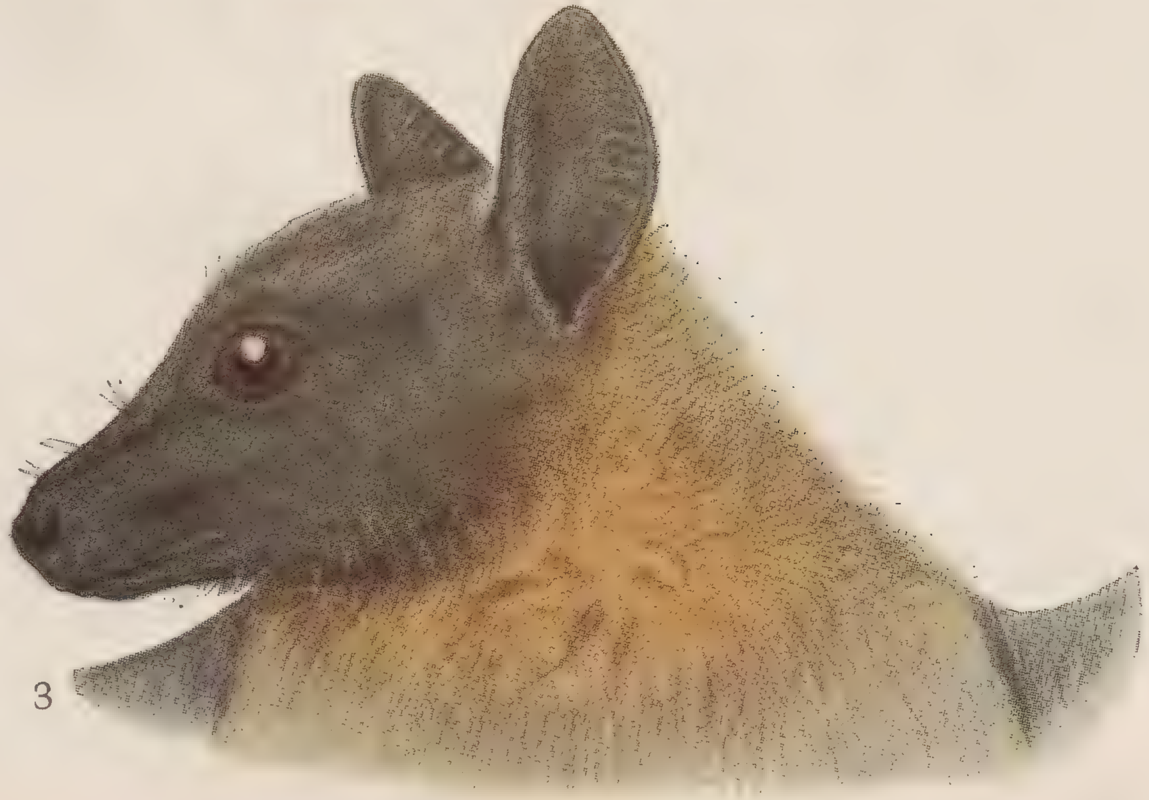
Fig. 26. *Mops* (*Allomops*) *osborni*, sp. nov. Right foot, from below, to show hairs on first and fifth digits. ($\frac{4}{1}$). *a*, a spoon-hair enlarged. ($\frac{24}{1}$) . . p. 556



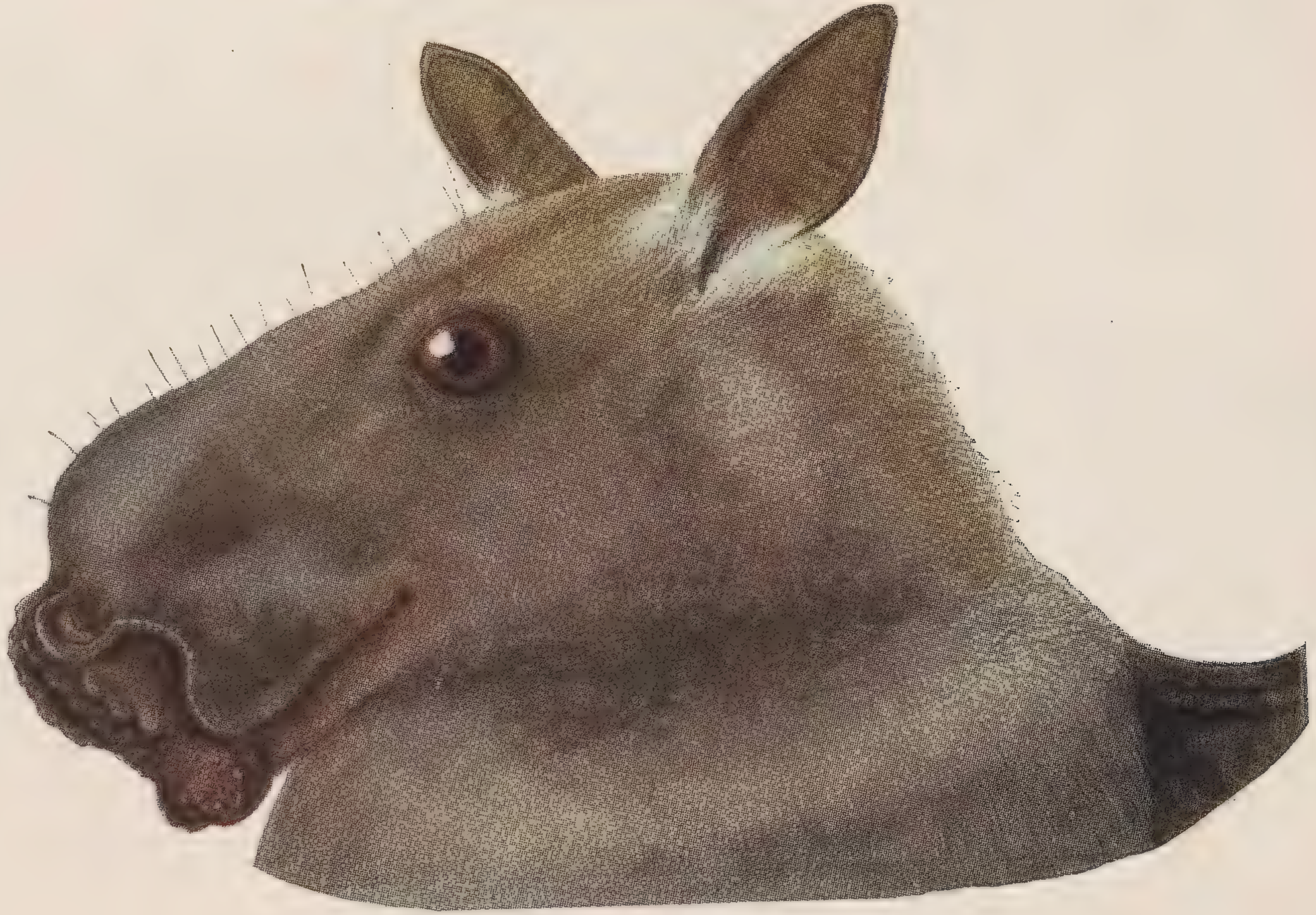
1



2



3



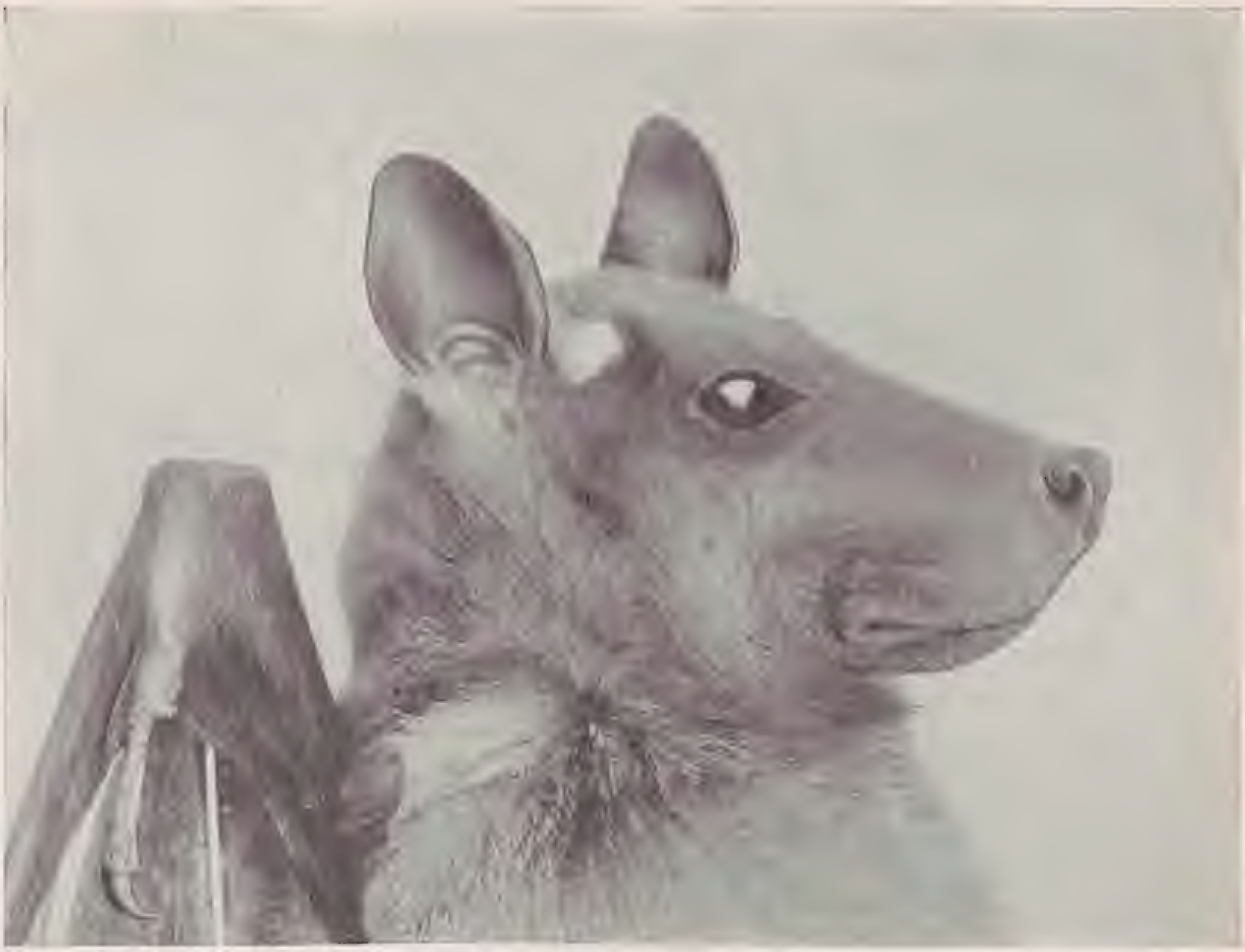
4

FIG. 1. *Epomophorus anurus* HEUGLIN.

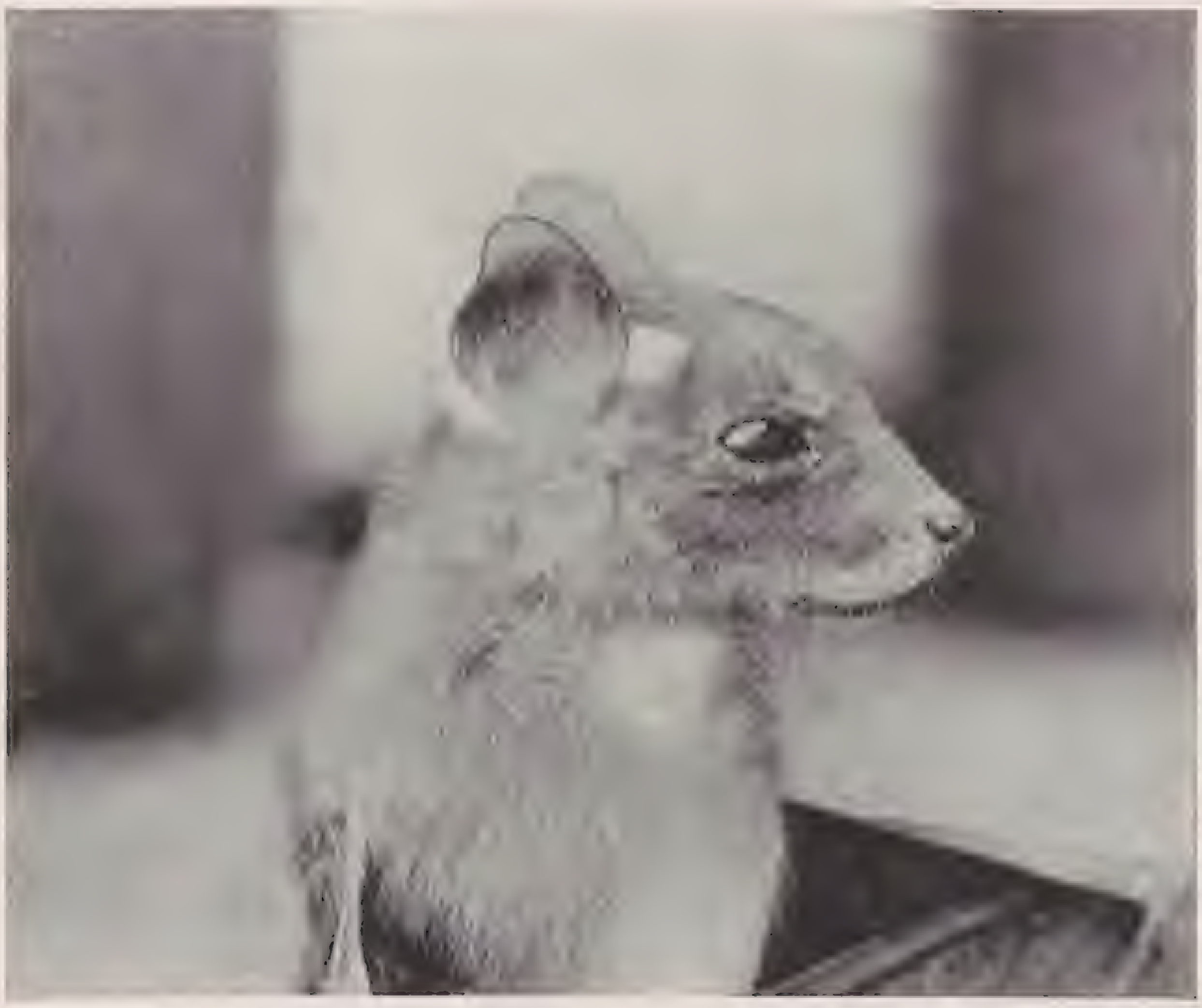
FIG. 3. *Eidolon helvum* KERR.

FIG. 2. *Epomops franqueti franqueti* TOMES.

FIG. 4. *Hypsignathus monstrosus* H. ALLEN.

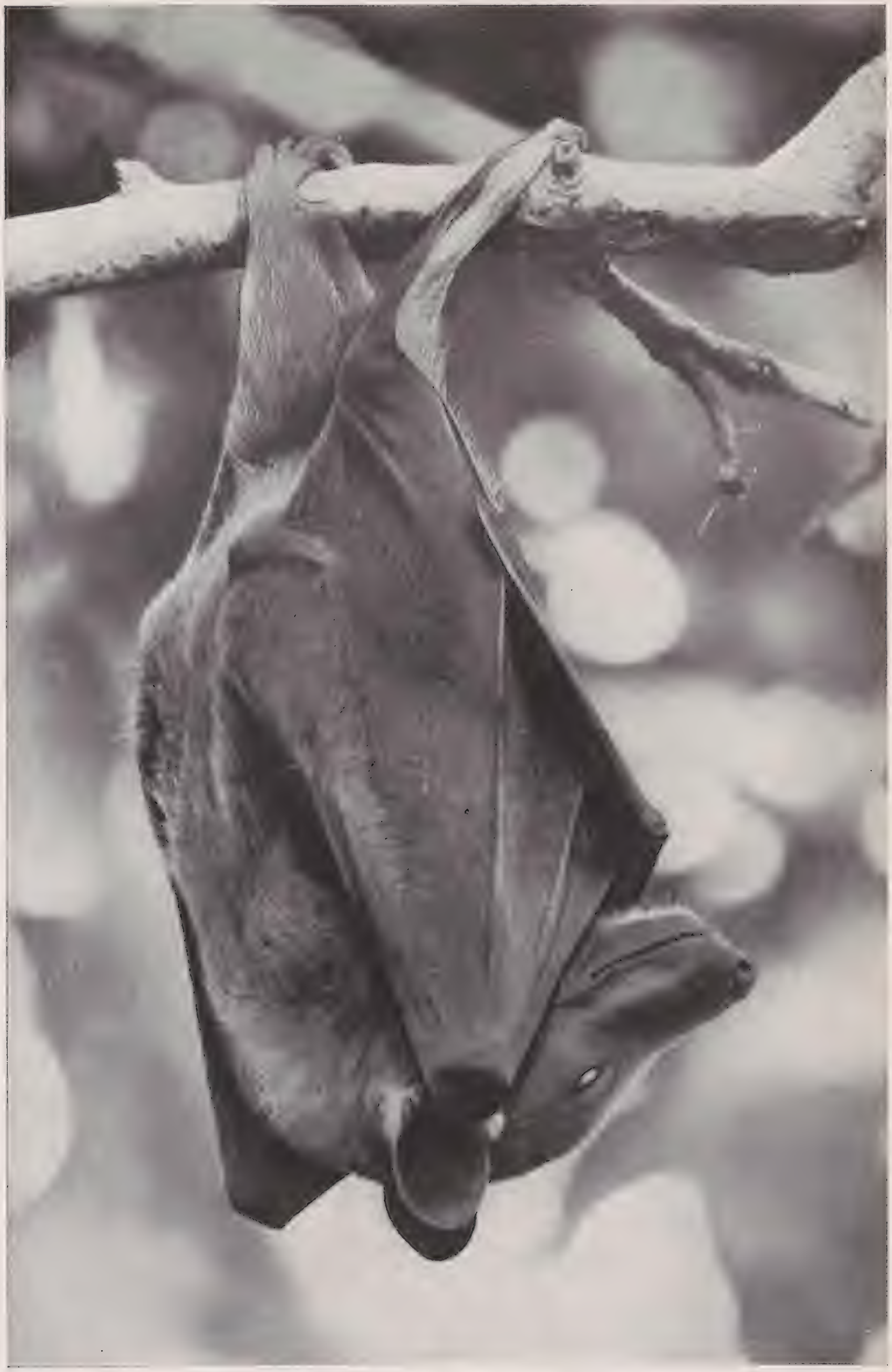


1

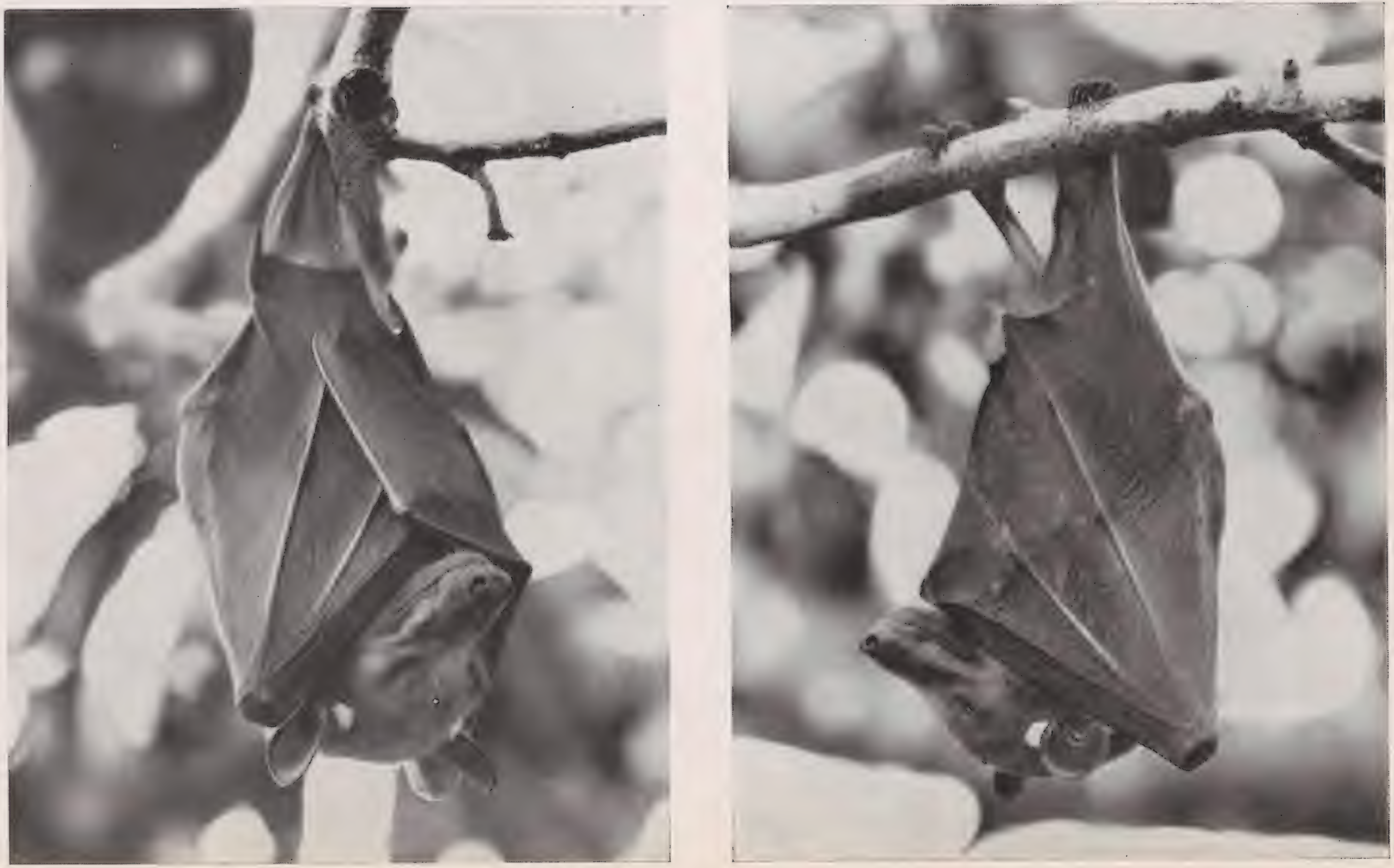


2

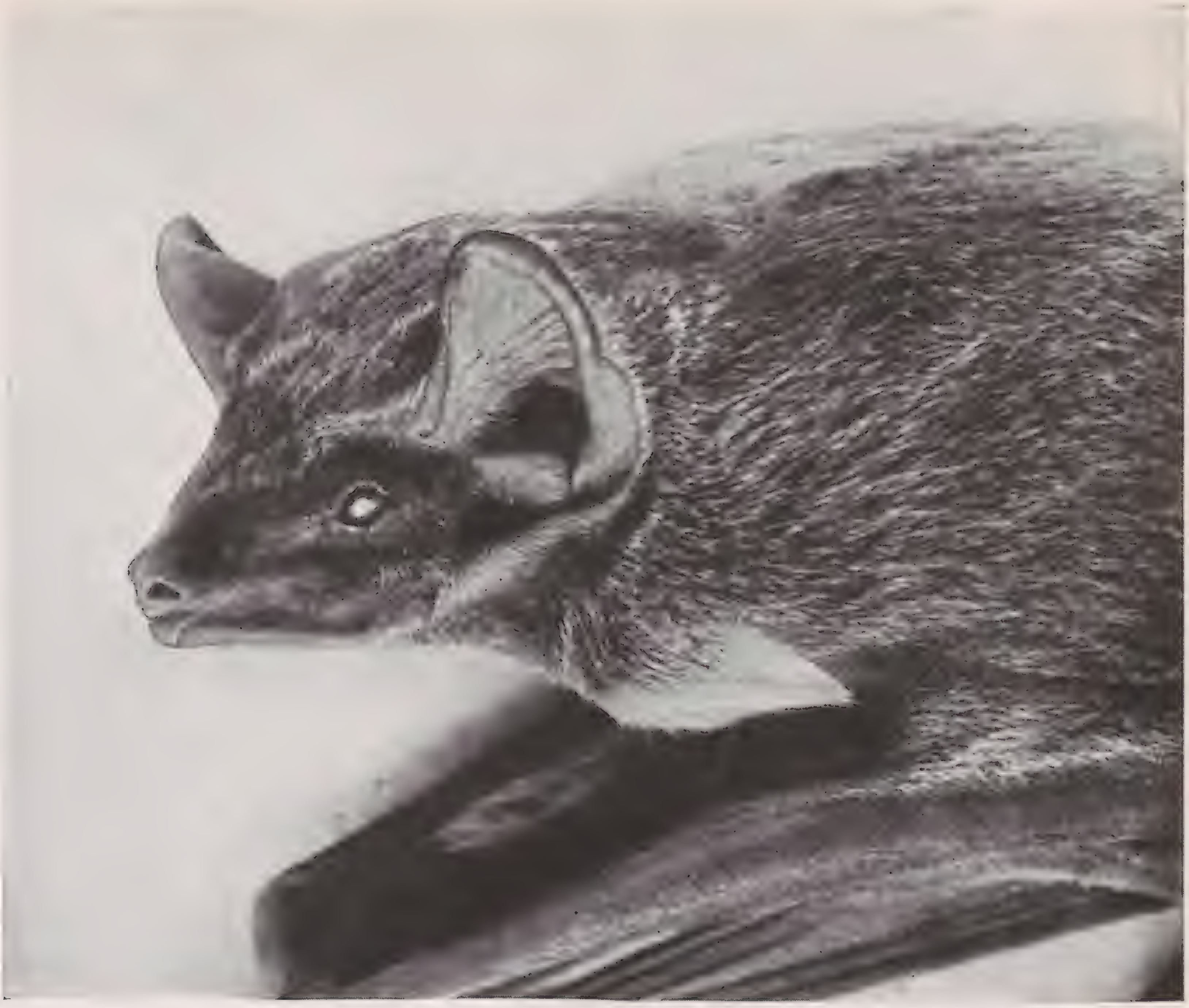
Fig. 1. EPOMOPS FRANQUETI FRANQUETI, Adult Male.
Fig. 2. " " " Young Female.



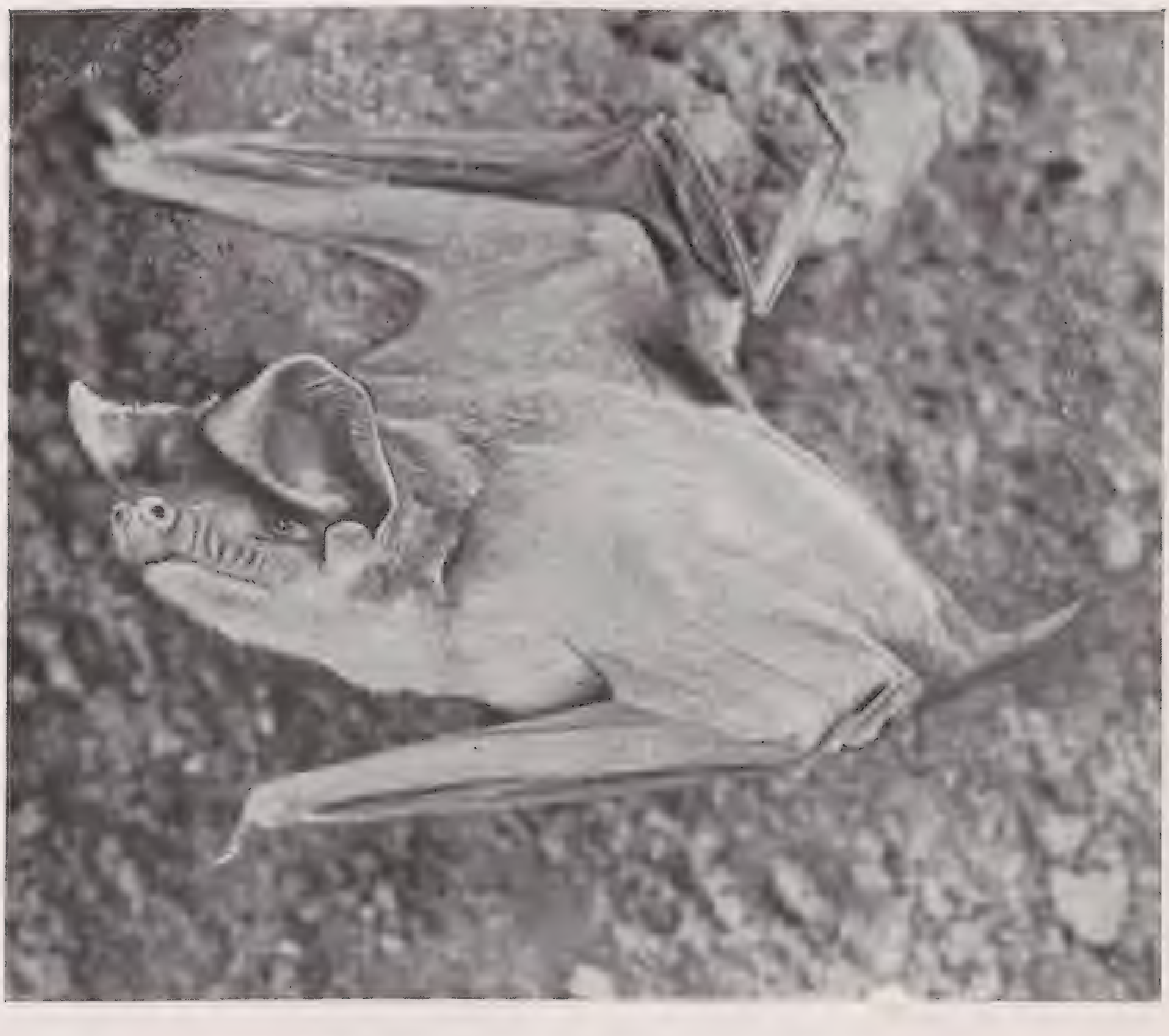
Epomophorus anurus.



EPOMOPHORUS ANURUS.

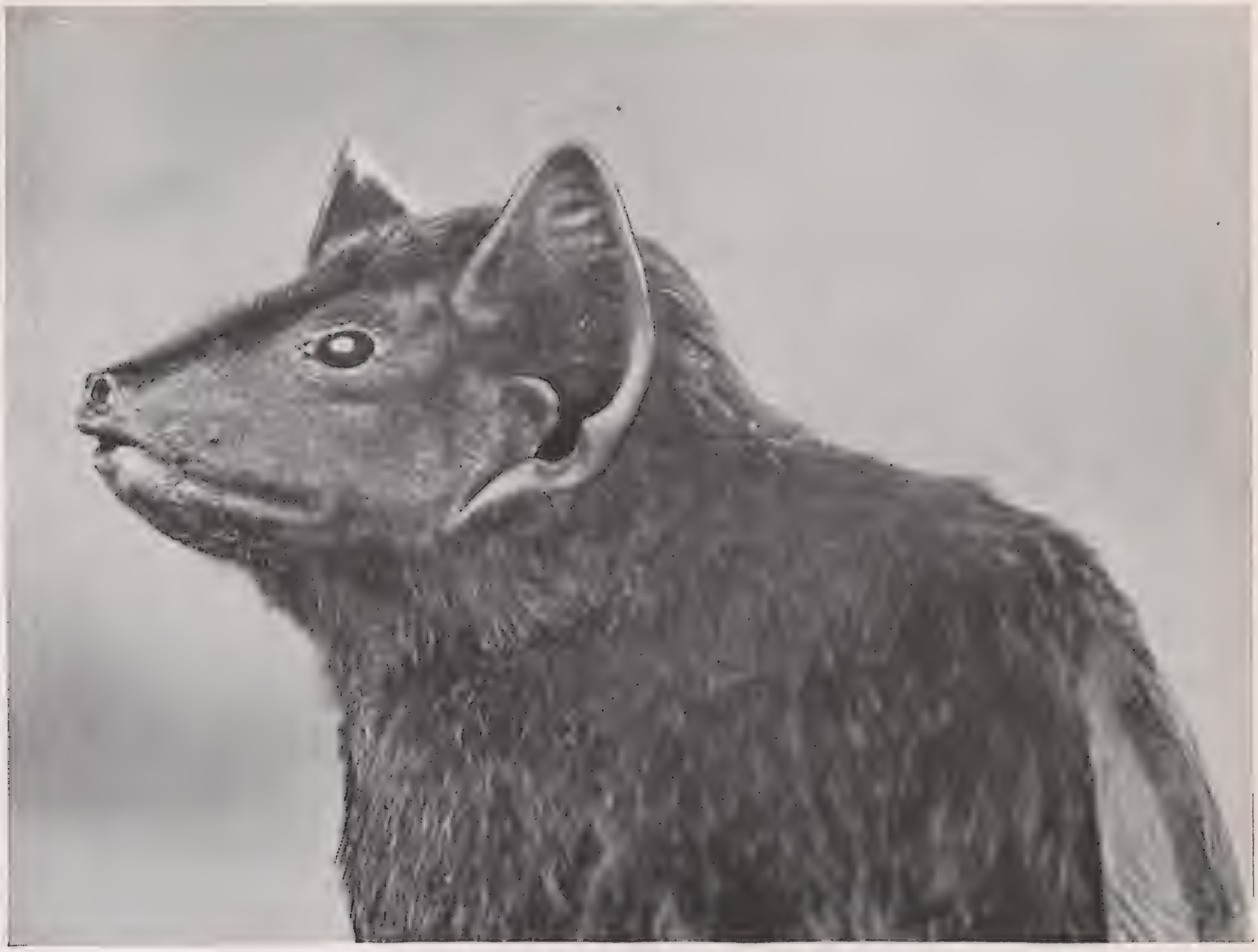


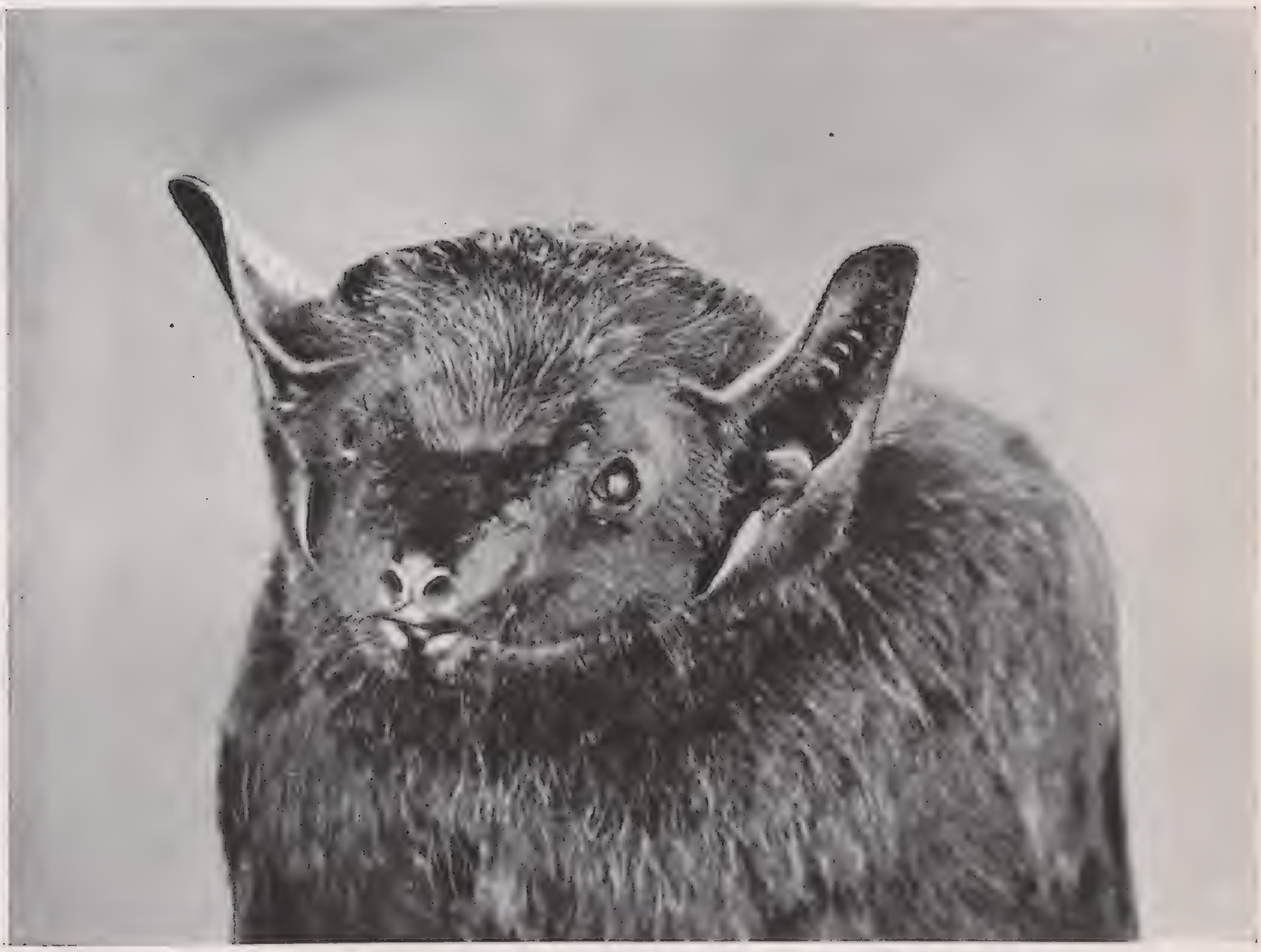
1



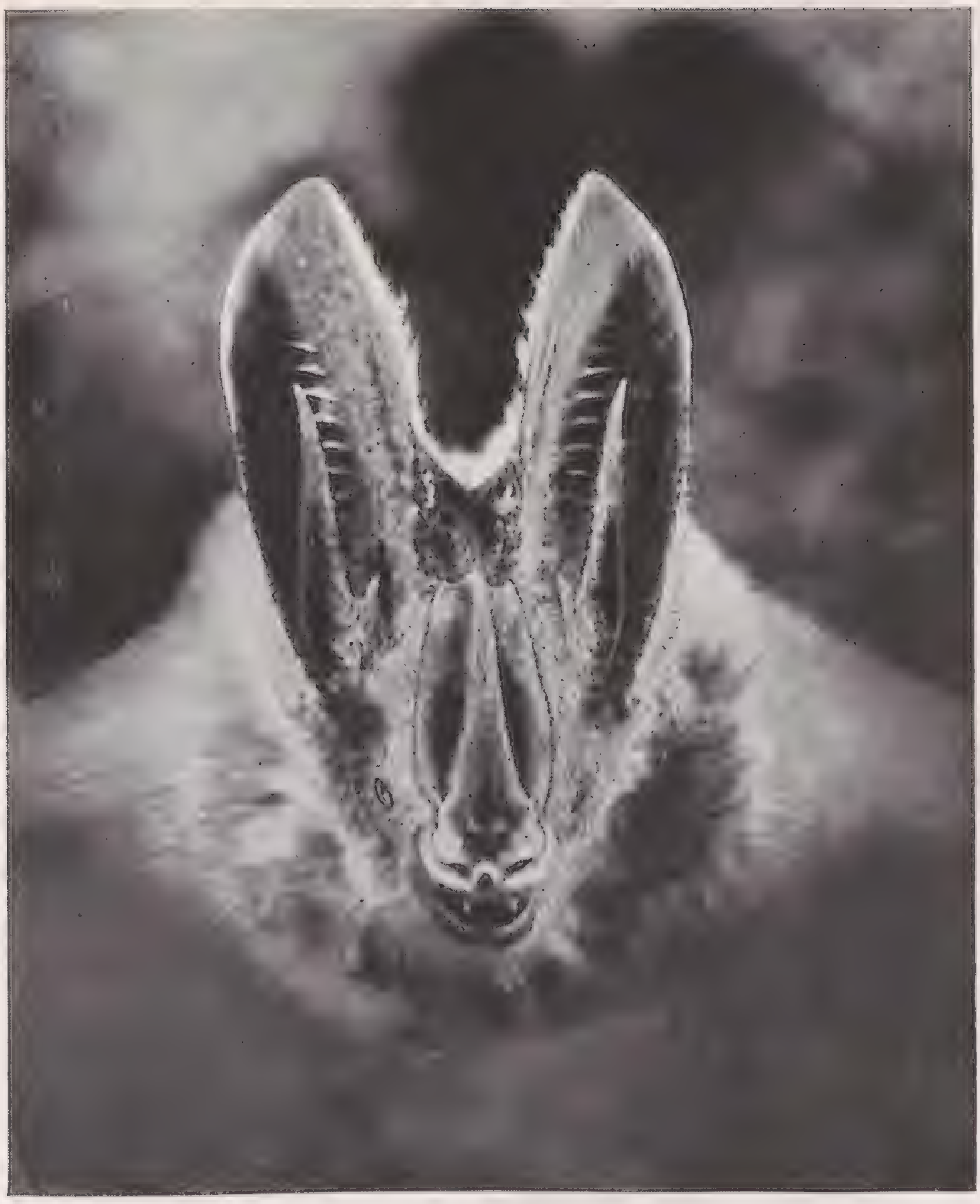
2

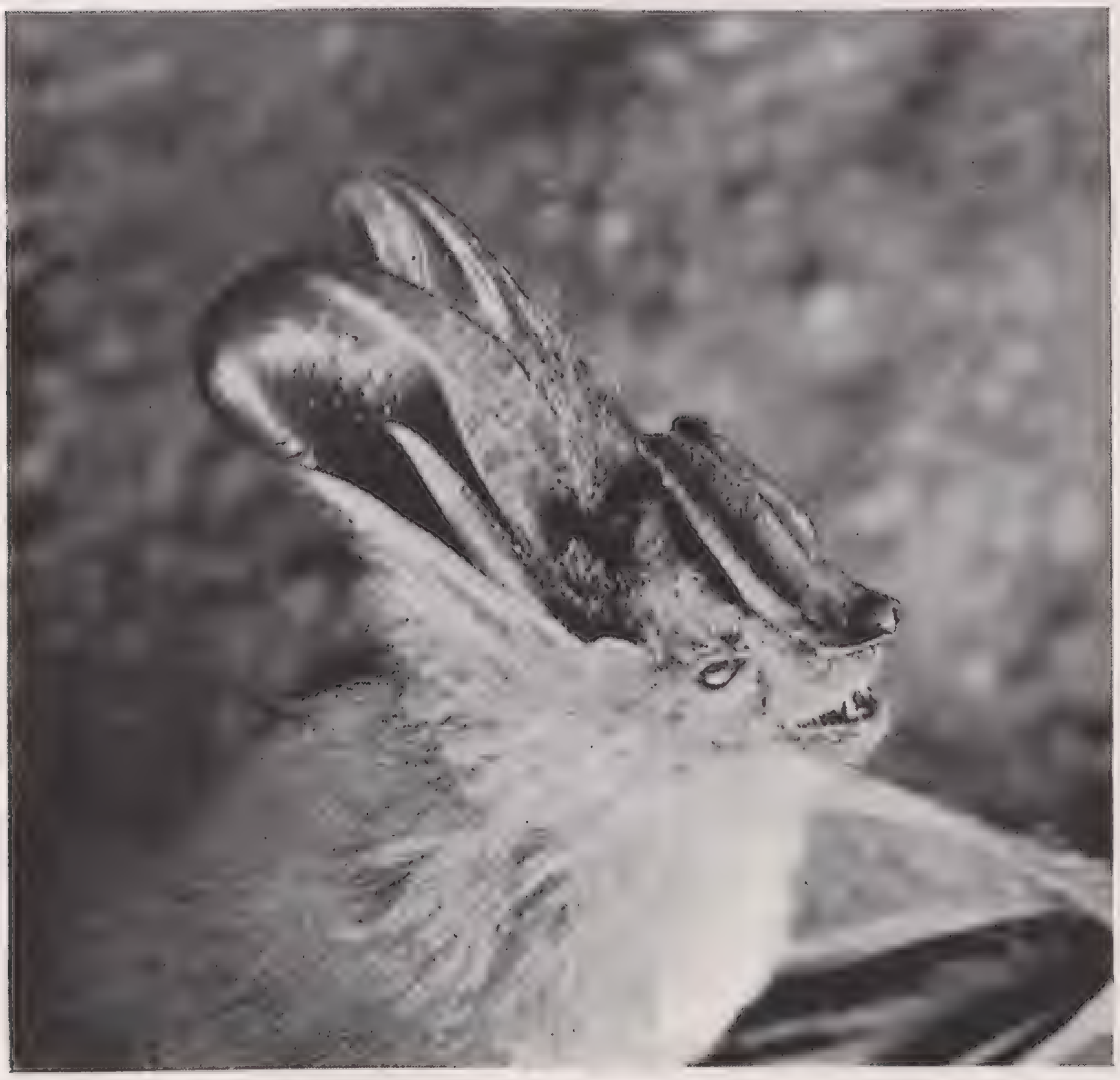
Fig. 1. TAPHOZOUS MAURITIANUS.
Fig. 2. MOPS TREVORI.



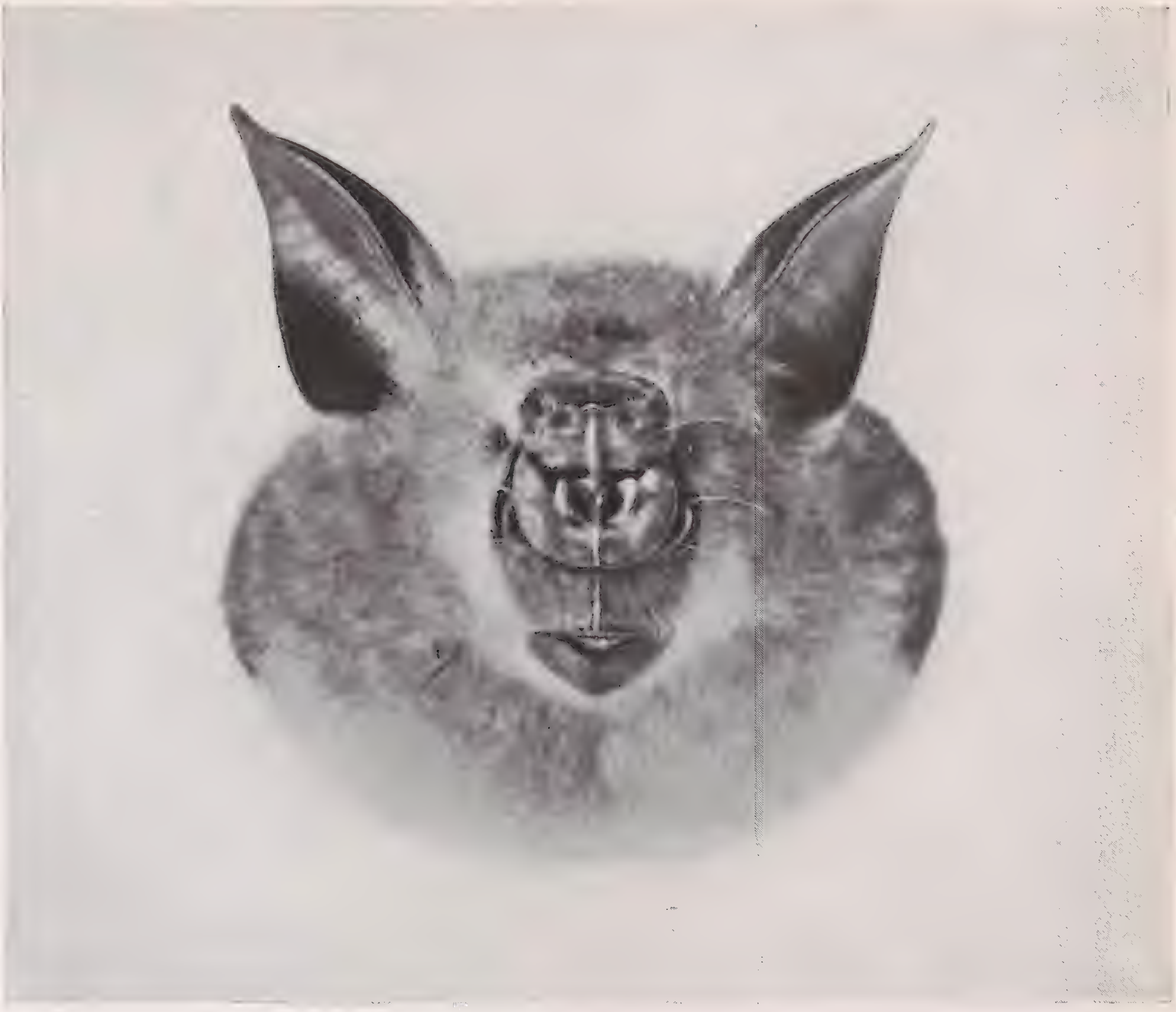


SACCOLAIMUS PELI.

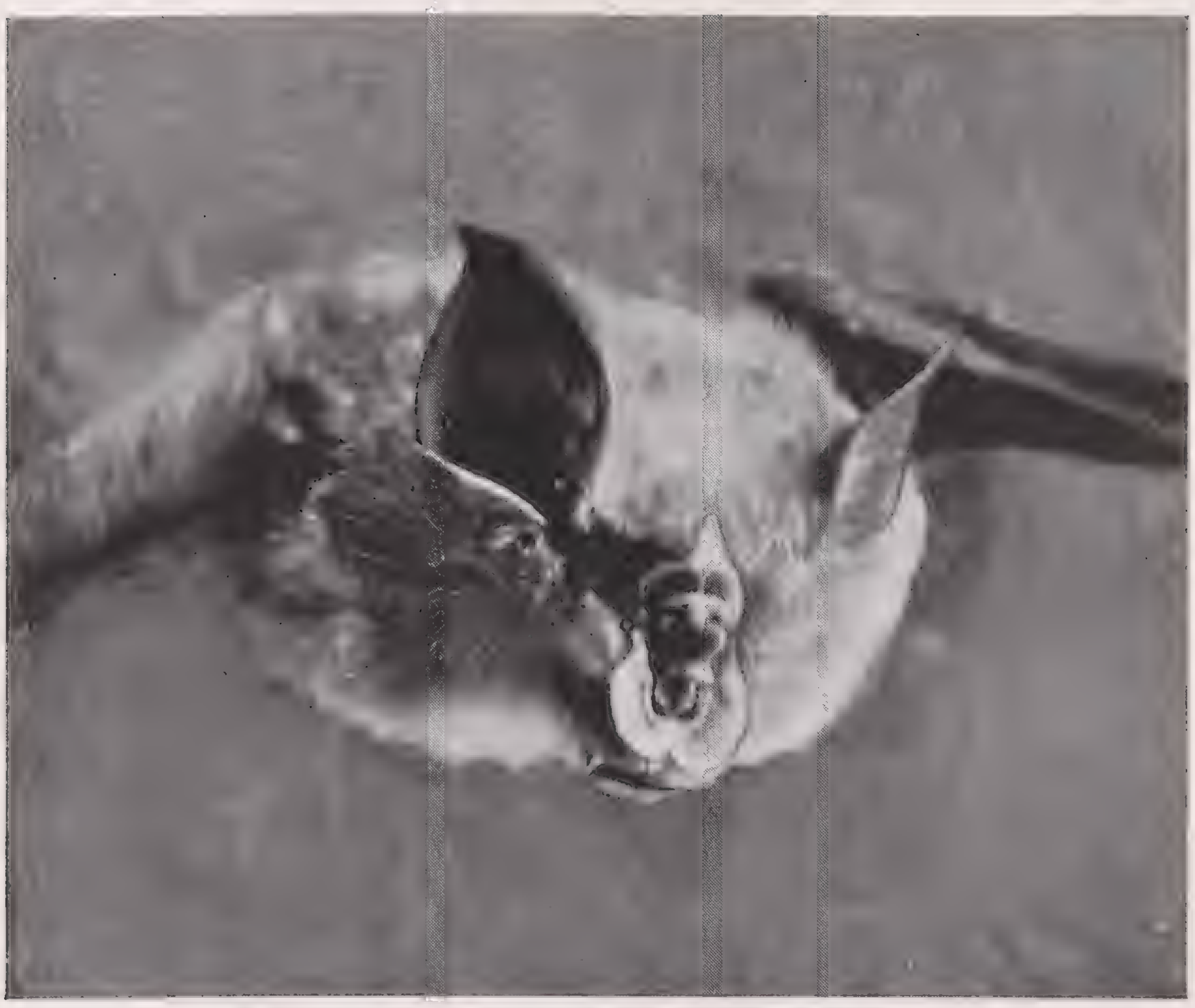




LAVIA FRONS AFFINIS.

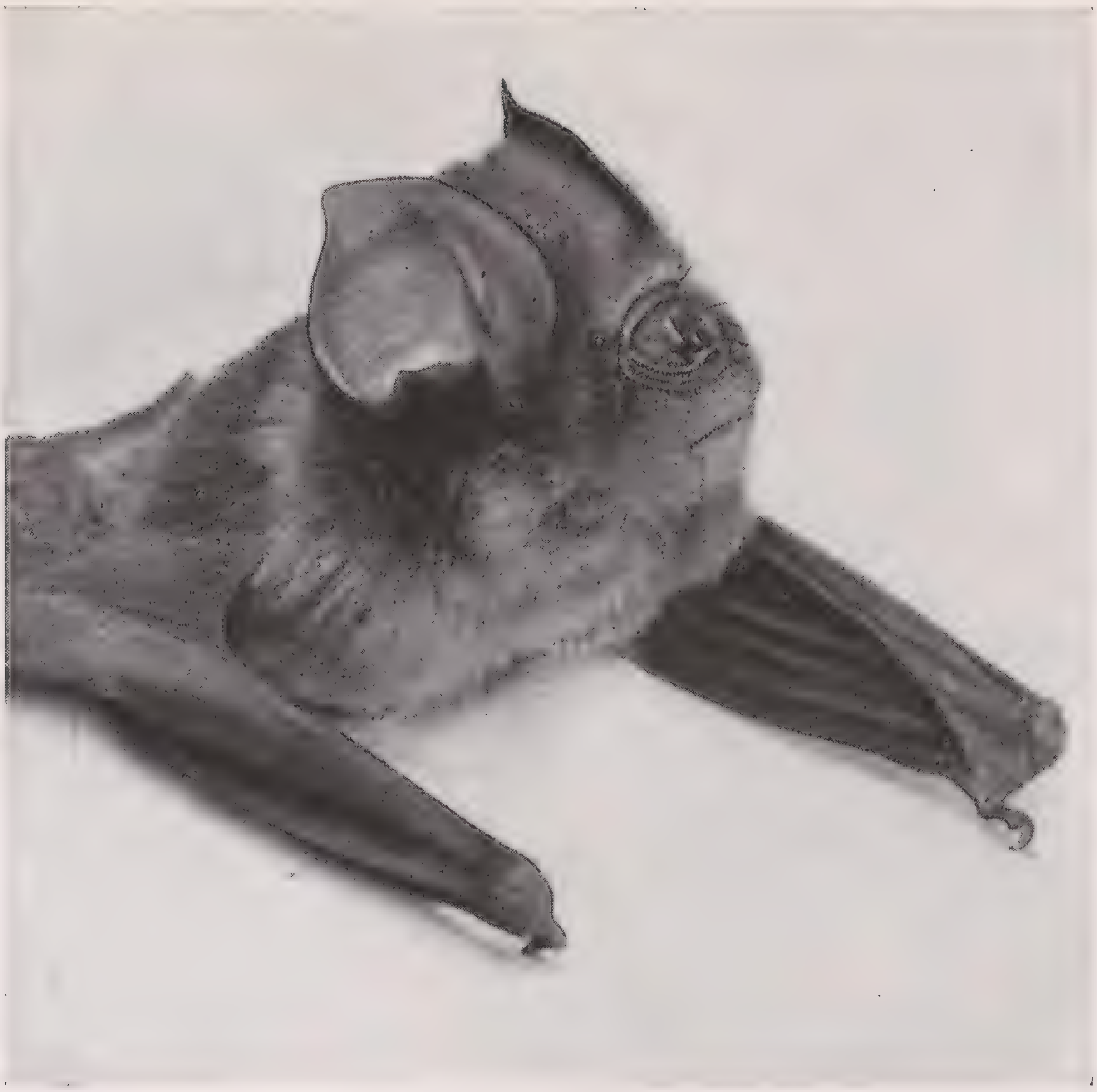


1



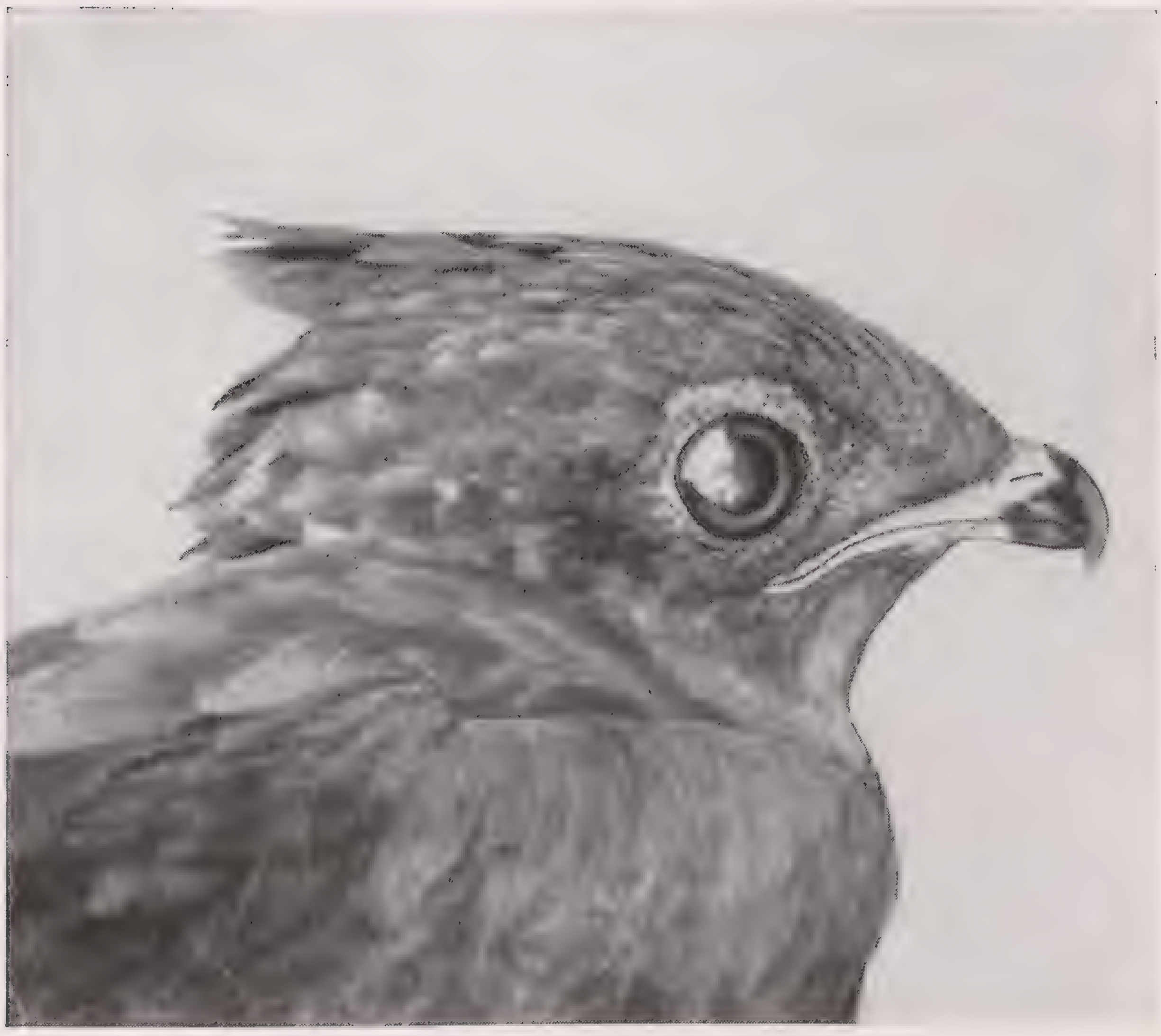
2

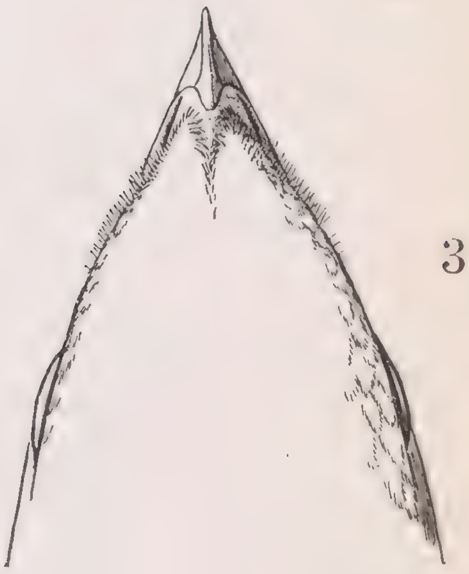
Fig. 1. Hipposideros gigas niangaræ.
Fig. 2. Rhinolophus axillaris.



1

2

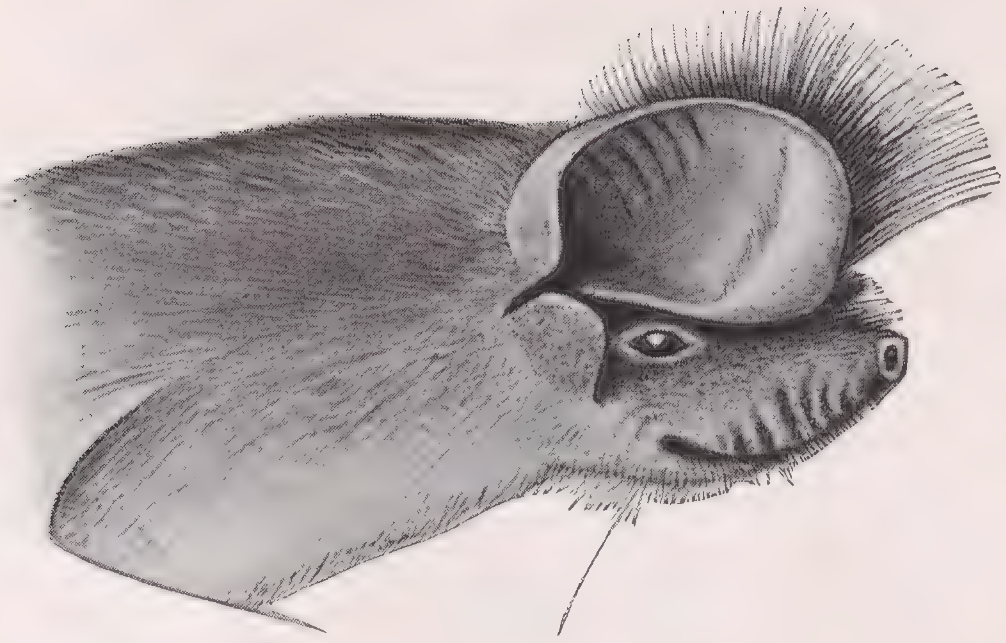




3

Fig. 1. Hipposideros caffer centralis.
Fig. 2. Machærhamphus anderssoni, Head.
Fig. 3. " " Bill, from above.

1



2

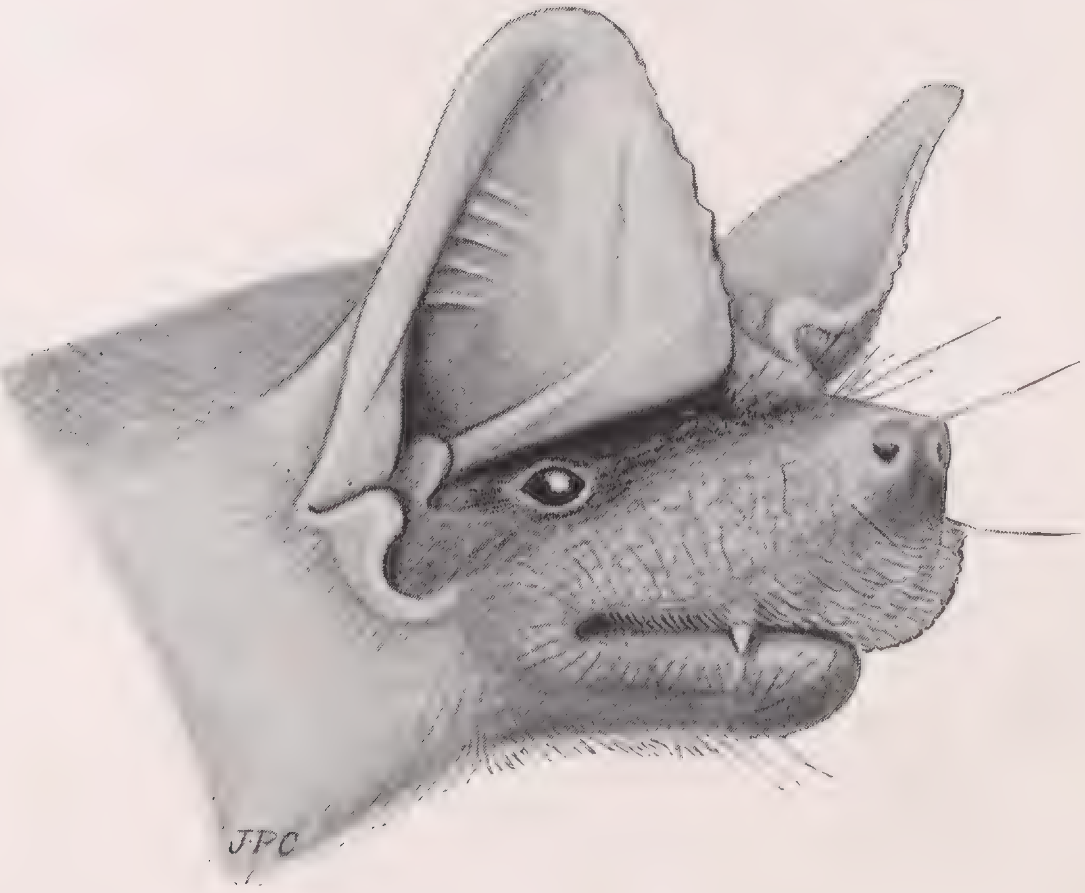
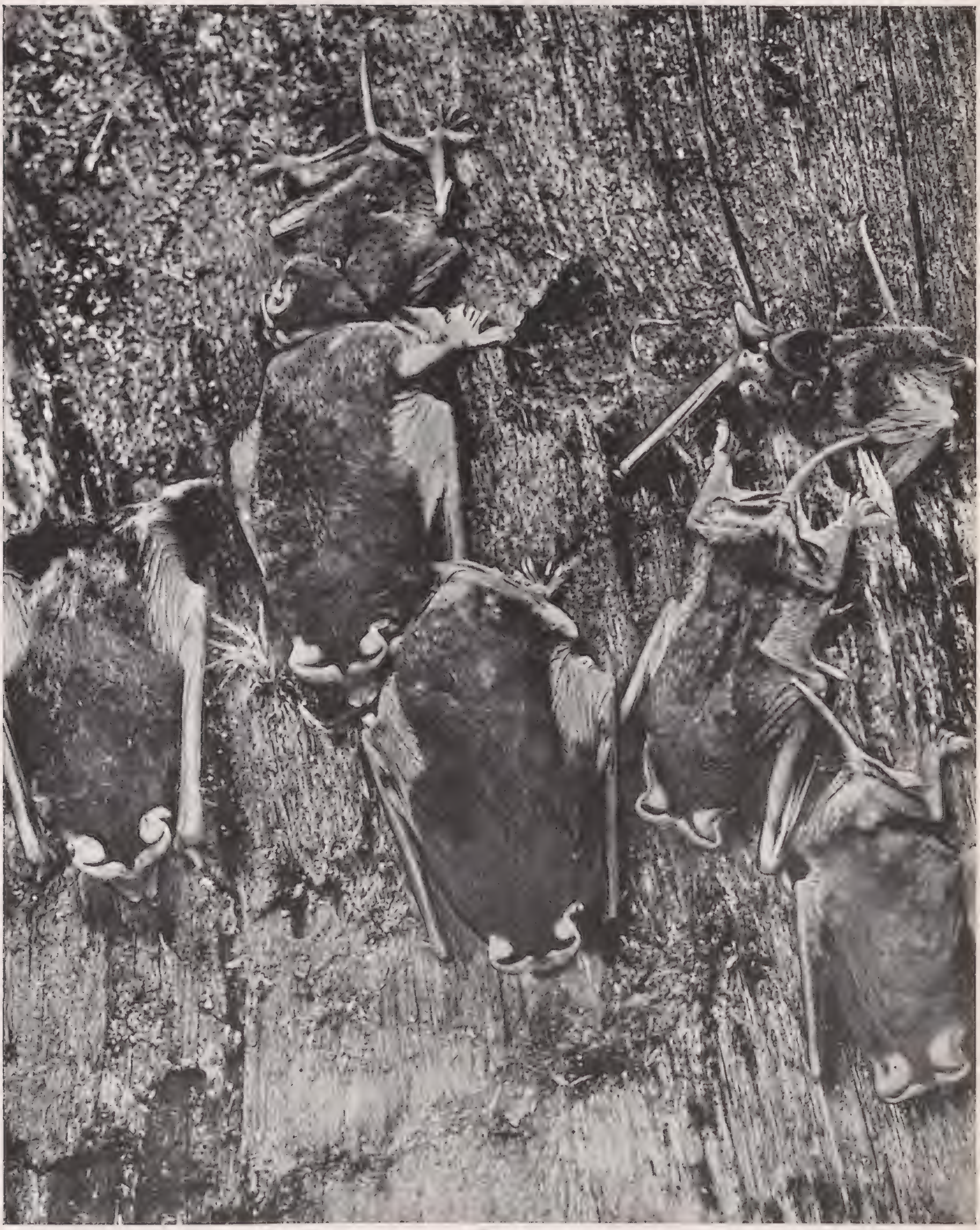
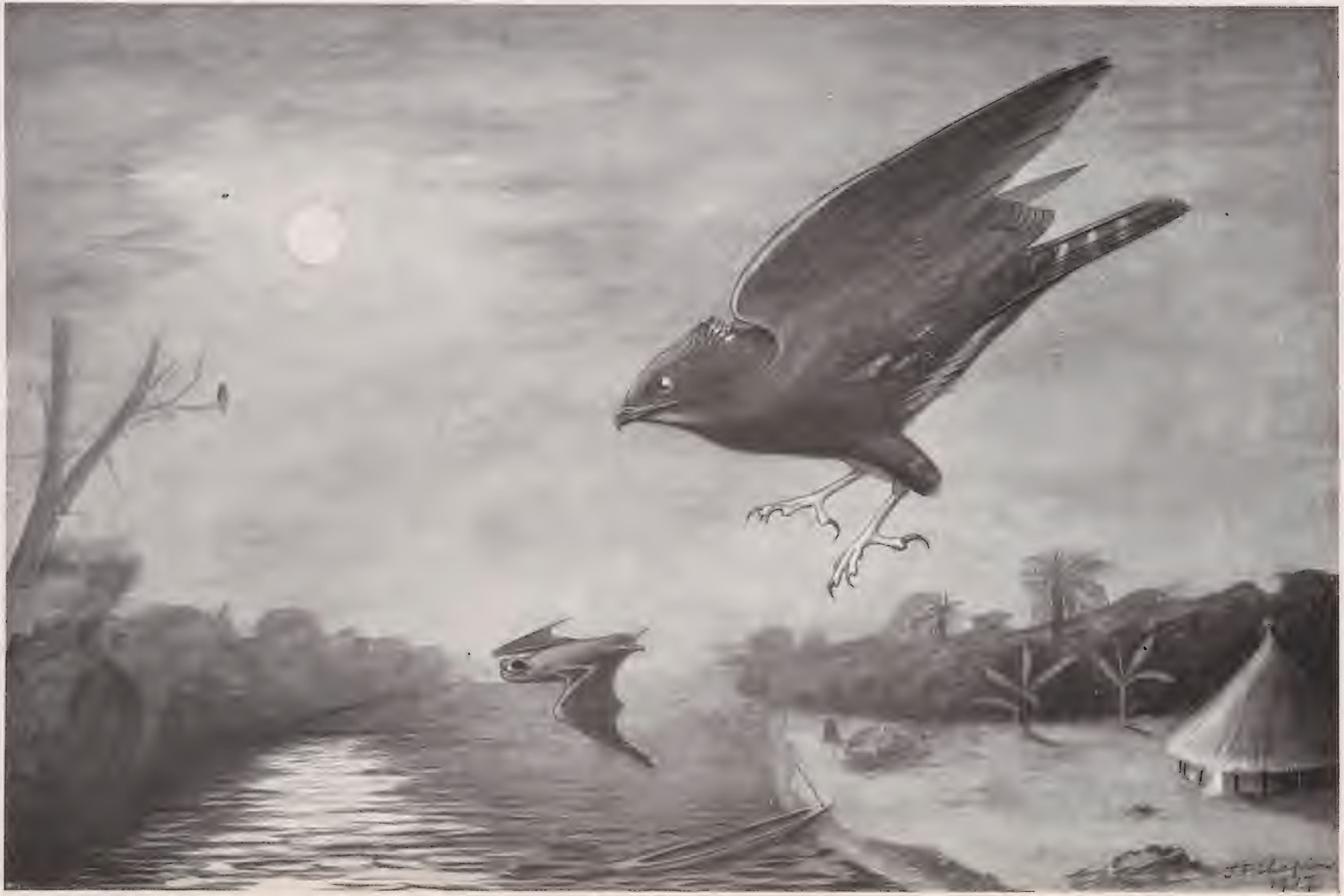


Fig. 1. CHÆREPHON (LOPHOMOPS) CRISTATUS.
Fig. 2. MYOPTERUS ALBATUS.



Mops congicus and Chærephon russatus.



Machærhamphus anderssoni pursuing Mops faradjius.

56.9,33(729.5)

Article XIX.— TWO NEW FOSSIL BATS FROM PORTO RICO.

By H. E. Anthony.

Plate LVI.

Among a large number of skulls and limb bones of bats found fossil in Porto Rican caves in 1916, examination has disclosed two species new to science; they are herewith described in this preliminary paper,[1] the rest of the material being reserved for a final report on Porto Rican mammals to be completed in the near future.

Monophyllus frater, sp. nov.

Plate LVI, Figs. 5, 6.

Type, No. 40941, Dept. of Mammals, from the Cueva Catedral, near Morovis, Porto Rico, July 29, 1916; collector H. E. Anthony. The type is a broken skull with complete rostrum and palate but with most of the braincase missing; the only teeth present are the last premolar and the three molars of the left side. Topotypes supply a few details indeterminable from the type.

Very similar to *Monophyllus portoricensis* but decidedly larger.

Skull narrow and elongate; rostrum very long, tubular, with shallow nasal depression in region of terminal suture, external nares subelliptical, opening decidedly upwards; interorbital constriction scarcely noticeable; braincase incompletely known but of rounded type; zygomatic arch doubtless complete; palate long, narrow, shallowly concave posteriorly, incisive foramina large; interpterygoid notch about midway between last molars and tips of pterygoid processes; dentition normal for the genus. Mandible unknown.

Dentition.— Only upper dentition known from specimens, lower dentition assumed to be normal and so indicated in following formula.

$\mathrm{I},\ \frac{2-2}{2-2};\ \mathrm{C},\ \frac{1-1}{1-1};\ \mathrm{Pm},\ \frac{2-2}{3-3};\ \mathrm{M},\ \frac{3-3}{3-3},\ = 34.$

The first tooth of the series present is the second premolar but the alveoli of the incisors, canine and first premolar indicate a strictly normal *Monophyllus* dentition. Cusp of second premolar the highest of the molar series, triangular in outline with trenchant edges and conspicuous anterior and posterior accessory cusp on cingulum;

---

[1] This is the fourth of the preliminary papers issued by the author on the Porto Rican fossils, the others appearing as follows:

Annals New York Academy of Sciences, Vol. XXVII, pp. 193–203, 9 August, 1916.

Bulletin American Museum Natural History, Vol. XXXV, Art. LXI, pp. 725–728. November 16, 1916.

Bulletin American Museum Natural History, Vol. XXXVII, Art. IV, pp. 183–189. January 29, 1917.

molars with flattened out and widened W-pattern, the cusps well developed, the commissures low; third molar with W incomplete, lacking the posterior stroke; outline of posterior border of first two molars with distinct indentation.

Measurements.

	Interorbital breadth	Breadth of rostrum at m^2	Length of palate	Breadth of palate inside m^2	Alveolar length of maxillary molar series
Monophyllus frater					
40941[1]	4.6	5.5	12.4	3.6	7.1
40944	4.8	...	11.6	3.8	6.8
40945	4.9	...	12.7	...	...
Monophyllus portoricensis					
39431	3.8	4.5	9.3	2.9	5.3

Specimens collected.— Five fragmentary skulls, only one of which, the type, shows any great assemblage of characters, but all are unmistakably of the same species. They were collected in the Cueva Catedral, near Morovis.

Remarks.— This large species of *Monophyllus* was apparently contemporaneous with *M. portoricensis,* the living species of the island, since a typical skull of the smaller *portoricensis* was found in the same deposit with the skulls of *frater.* It is partly for this reason that *frater* has been accorded full specific rank instead of being placed in the line of direct ancestry of *portoricensis.* It is a case similar to that of the two species of *Chilonycteris* found on Porto Rico today although the size difference between the two species of *Monophyllus* is not so great.

The relationship with *portoricensis* is very close however and the differences appear to be in size rather than detail. Were the two forms from adjacent islands rather than from the same island doubtless they would best be considered as subspecifically related. From *portoricensis* the fossil species may be readily distinguished by the greater length and breadth of the rostrum and palate and by the much heavier dentition.

M. frater is probably even more closely related to the larger *M. luciæ*[2] from the Island of St. Lucia, Lesser Antilles, than to the small *portoricensis.* Judging from the material secured *frater* is the largest species of the genus.

---

[1] Type.

[2] Through the kindness of Mr. Gerrit S. Miller, Jr., the author has been able to borrow specimens of *Monophyllus luciæ, clinedaphus* and *plethodon* from the collection of the United States National Museum, and has thus, with the material in the American Museum, examined all the known species of the genus.

Compared with *M. luciæ* the fossil *Monophyllus* may be distinguished by its rather longer rostrum and noticeably longer toothrow.

The possibility that this species may yet be found living is obvious and only a long period of extensive collecting can give positive negative evidence.

Phyllonycteris major sp. nov.

Plate LVI, Figs. 1, 2.

Type, No. 40925, Dept. of Mammals, from the Cueva Catedral, near Morovis, Porto Rico, July 29, 1916; collector H. E. Anthony. The type is a skull nearly complete but lacking full dentition; m^1 and m^3 on left side, m^2 and m^3 on right side are the only teeth present.

Closely related to *Phyllonycteris poeyi* but noticeably larger, with wider braincase and heavier dentition.

Rostrum long, deep and rather tubular, external nares opening slightly upward, nasals marked as flattened ridge along rostrum; interorbital constriction very slight; braincase high and rounded, not rising abruptly from rostral plane, broader than deep, expanded posteriorly, very low sagittal crest; mastoid process poorly developed; zygomatic arch incomplete; palate very long, shallowly concave, narrowed anteriorly, small incisive foramina present, pterygoid region very long, processes flattened, concave for half their extent; V-shaped interpterygoid notch not reaching plane of last molars; very low median ridge along floor of interpterygoid fossa; poorly developed basisphenoid pits; paroccipital processes well developed; bullæ unknown; mandible (not particularly associated with type skull) long and narrow; horizontal ramus very straight, of good depth; ascending ramus scarcely elevated above horizontal ramus; coronoid high, wide, triangular; condyle much lower than coronoid, about level with molar crowns; dental foramen large and conspicuous.

Dentition.[1]— I, $\frac{2-2}{2-2}$; C, $\frac{1-1}{1-1}$; Pm., $\frac{2-2}{2-2}$; M, $\frac{3-3}{3-3}$ = 32.

Dentition heavier than that of *P. poeyi*.

Upper. Incisors not present in any skull but alveoli indicate incisors as in *poeyi*, a larger inner pair, a smaller outer pair, all in contact but separated by diastema from canines; canine large, simple, with well developed anterior and posterior cutting edges and narrow internal cingulum; first premolar small, subterete, second premolar rather more than twice as large as first, with single triangular cusp, practically no cingulum; molars with low crowns not reaching level of crown of second premolar; first molar with crown about as broad as long, paracone and metacone scarcely distinguishable on the external cutting edge, internal crushing surface broad, outline from above subelliptical; second molar wider than long, the greatest length along external cutting edge, crown pattern of raised cutting edge with two cusps and broad internal crushing surface; third molar about half size of second, crown flattened, subtriangular, the tooth set inside of extreme border of molar series.

Lower. Incisors not present but indicated as minute, subequal; canine large, with prominent posterior notch on cingulum; first premolar not known but alveolus as large as that of second; second premolar with well developed triangular median cusp; first molar with crown longer than wide, flattened, outline of cusps lost; second molar subrectangular, slightly longer than wide, crown flattened, with trace of shallow concavity, cusps very faintly indicated; third molar smaller than either first or second molars.

---

[1] Description taken from type and topotype material.

Measurements.

	Greatest length	Interorbital breadth	Breadth of braincase	Breadth of rostrum at m^2	Length of palate	Breadth of palate, inside m^2	Alveolar length of maxillary molar series	Length of mandible	Alveolar length of mandibular molar series
Phyllonycteris major									
40925[1]	26.7	5.5	11.3	7.8	10.7	4.5	6.7		
40926	....	5.9	....	8.1	11.1	4.8	6.7		
40927	27.2	5.5	11.1	7.6	10.7	4.5	6.8		
40928	27.3	5.9	11.2	7.8	10.6	4.3	6.7		
40929	28.1	5.7	11.4	8.2	10.7	5	6.8		
40930	27.7	5.6	11	7.3	....	5	....		
40932	....	5.7	11.3	7.6	....	4.9	6.8		
40933								18.1	....
40934								17.6	8.3
Phyllonycteris poeyi									
23758	25.7	5.2	10.5	7.3	10.5	4.5	6.1	16	7.3
23759	24.7	5.3	9.9	6.9	9.7	4.3	5.7	15.4	7.2

Specimens collected.— 60 fragmentary skulls, only a few of which are nearly complete; 22 mandibles mostly without any teeth, and small fragments not worth listing.

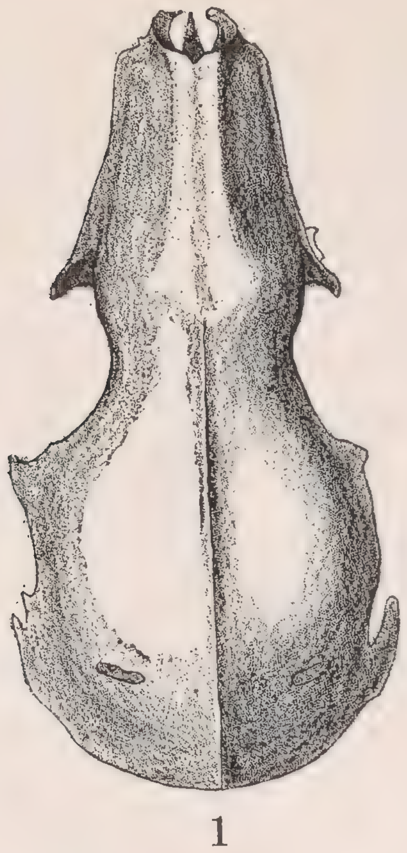
Remarks.— *Phyllonycteris major* is so obviously congeneric with *poeyi* that comparison elsewhere is unnecessary. From *poeyi* it may be told by its larger size, more widely expanded braincase and much larger second upper premolar.

This species was found only as a fossil and in but one cave. It was contemporaneous with *Nesophontes* as well as with *Stenoderma rufum* and other bats to be found living today. Possibly *P. major* may be found as a living bat, the chances for this being very favorable since *P. poeyi* and the species of the related genus *Erophylla* occur only in isolated localities and escape notice for long periods, as witness the rarity till recently of *P. poeyi* and *E. sezekorni* in collections.

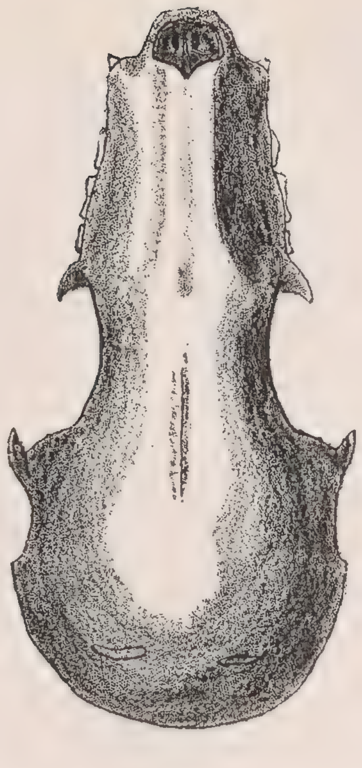
Heretofore *Phyllonycteris,* with but a single species, has been known only from Cuba. The discovery of a closely related species of this peculiarly West Indian genus upon Porto Rico is an added bit of evidence in favor of an earlier intimate connection between the now detached islands.

---

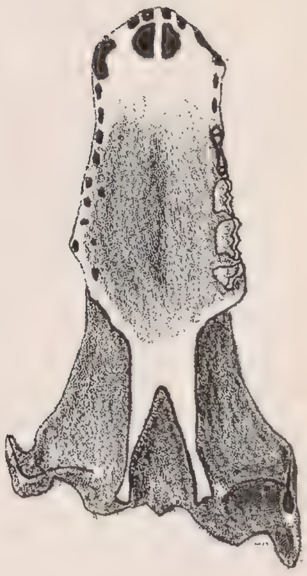
[1] Type.



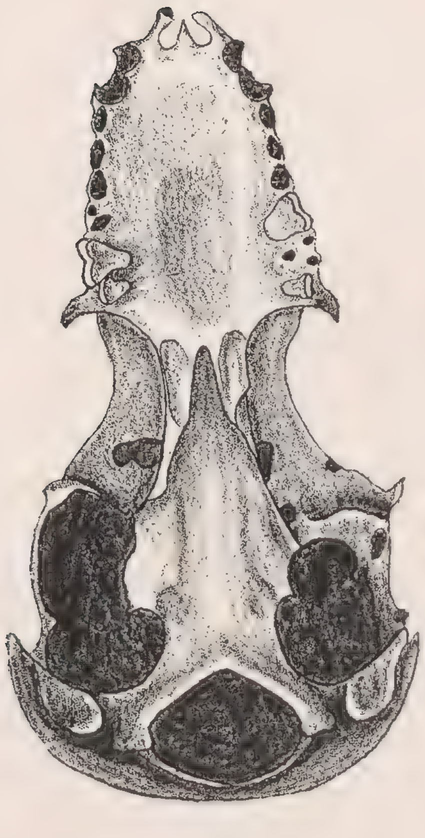
1



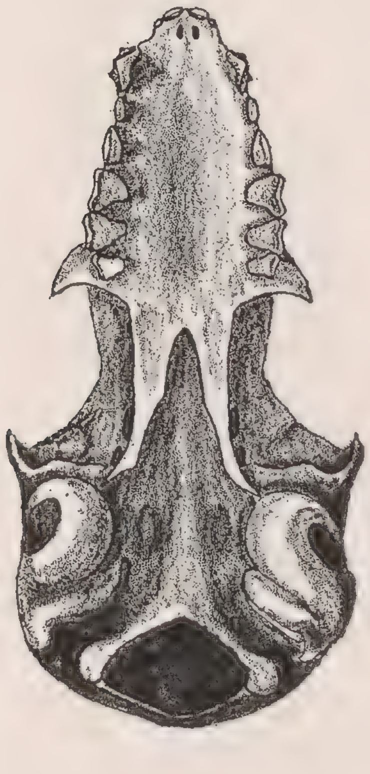
3



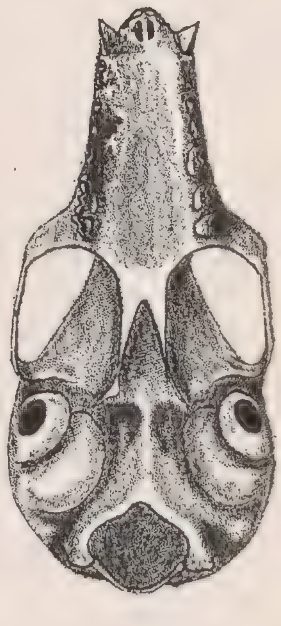
6



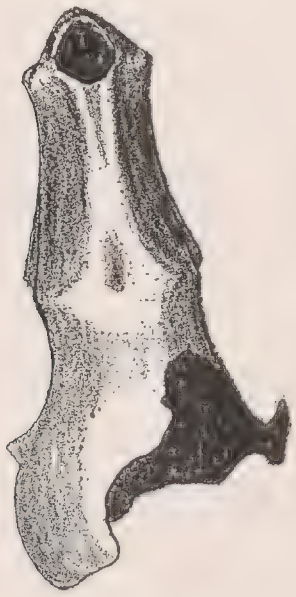
2



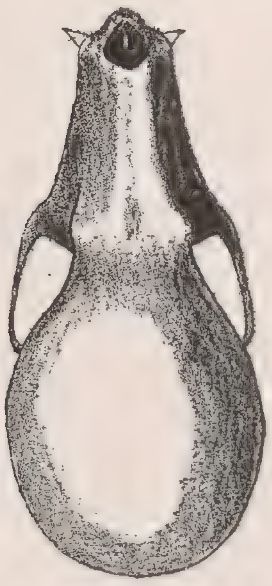
4



8



5



7

Figs. 1, 2. *Phyllonycteris major.*
" 3, 4. " *poeyi.*

Figs. 5, 6. *Monophyllus frater.*
" 7, 8. " *portoricensis.*

56.9,4Z(1181: 78.8)

Article XX.— A PALEOCENE BAT.

By W. D. Matthew.

In proportion to their numbers and variety in the modern fauna, fossil Chiroptera are very little known. There are only ten or twelve extinct genera on record, and the majority of these are based on fragments of very doubtful reference. Fossil remains of modern genera, usually of species still existing, are commonly found in cave deposits; and in some of the European Tertiary formations as far back as the Upper Eocene remains of several kinds have been found, none of them very widely different from those now living.

In North America no conclusive evidence of Tertiary bats has hitherto been recorded. Marsh in 1872 referred to the Chiroptera the genera *Nyctitherium* and *Nyctilestes*, based upon fragments of jaws from the Bridger Eocene, but their ordinal position is very doubtful. Cope in 1880 described *Vesperugo anemophilus* from the Wind River Eocene, based on the front of a skull which was never figured or adequately described and appears to have been lost before his full descriptions of this fauna were published. Whether it was really a bat or no will probably never be known. All the later explorations in the American Tertiaries have failed to yield any remains which could be called chiropteran, save for a somewhat doubtful specimen from the Wasatch (undescribed) and the skull which is the subject of this notice.

Zanycteris paleocenus gen. et sp. nov.

Type, Amer. Mus. No. 17180, an incomplete skull from beds at the base of the Wasatch formation, near Ignacio, southwestern Colorado, Upper Paleocene or lowest true Eocene, found by Walter Granger, Amer. Mus. Exped. 1916.[1] The molars and one canine are complete, the premolars broken off. The palate and face are fairly complete and the top of the skull back nearly to the occiput, but the basicranial region is mostly missing.

Generic characters: Dentition $\underline{?.\,1.\,3.\,3.}$ Incisors not determinable. Canine small, pointed, oval in cross section, not blade-like. Premolars about as large as canine, two-rooted, the crowns not preserved. P^2 with short diastemata in front of it, slightly spaced behind, its roots connate;

---

[1] See note upon the stratigraphy of these beds by Mr. Granger in a forthcoming article in this Bulletin.

p^{3-4} somewhat crowded against the molars, the roots more distinctly separated, no inner root on p^4. First molar large, second smaller, third quite small; their pattern much as in Stenodermінæ and *Phyllonycteris*, the crown of m^1 a shallow triangular basin with rugose surface margined externally by a low crest (paracone + metacone) and a distinct almost shelf-like external cingulum; internally the basin is margined by a low protocone, with slight crests extending towards the external angles of the tooth, and a somewhat stronger posterointernal cingulum curving upwards at its anterior end to the tip of the protocone. The third molar is quadrate with low crests at inner and outer margins and a broad shallow basin between; the second molar is intermediate in structure between m^1 and m^3. Muzzle elongated and rather slender in front of the true molars, cranial portion of skull rather short and wide, zygomatic arches probably complete. Braincase of moderate size, sagittal crest low, obscure.

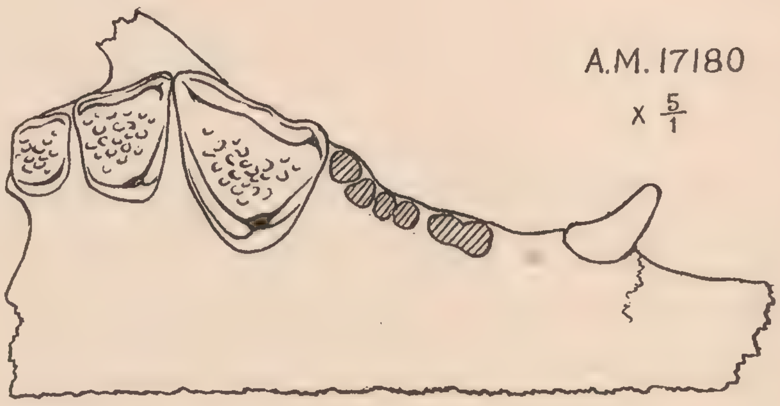


Fig. 1. *Zanycteris paleocenus* gen. et sp. nov. Right maxilla, palatal view, enlarged to five diameters.

Specific characters: The first molar is quite sharply triangular, somewhat extended backward at the external angle; m^2 more quadrate, and extended forward at the external angle; m^3 is quite small, quadrate, the outer crest low, the protocone ridge higher. The measurements are as follows:

Canine to m^3, length	8.5
P^2–m^3, length	6.5
M^{1-3}, length anteroposteriorly	4.3
M^1, " along outer border	2.3
" width transversely	2.0
M^2, length along outer border	1.3
" width transversely	1.6
M^3 length anteroposteriorly	0.9
" width transversely	1.0
Width of palate at p^2	4.4
" " " " m^1	8.6

The basicranial portion of the skull is not preserved.

This genus combines characters of the Stenodermінæ, Phyllonycterinæ and Sturnirinæ of Miller's arrangement, showing the peculiar and specialized molar construction characteristic of those three groups; but it does not appear to be close to any living genus and the long slender muzzle and small size of the canine are unusual features for a bat. In the modern

Stenodermінæ the muzzle is either moderately short, or very short; in the Phyllonycterinæ it is longer, but wide in the premolar region; the canine is much larger in both groups. It appears to be reasonably certain that it belongs to the Phyllostomatidæ and to that section of them with specialized frugivorous molars. The great antiquity of the genus suggests that this is a more ancient specialization than would be anticipated, and hints at a very ancient origin for the chiropteran order.

The Phyllostomatidæ are at present all tropical American; a genus from the Phosphorites has been referred to the family, on the inadequate basis of a lower jaw with m_{2-3} preserved.

This is the earliest chiropteran on record. Its highly specialized character and resemblance to modern genera add to the evidence derived from *Pseudorhinolophus*, *Archæopteropus* and other extinct genera that the Chiroptera are a very ancient and early differentiated order, although it gives no light on the date of their adaptation to flying.

This discovery adds one more to the many groups of Mammalia now limited to tropical or South America, but found fossil in the Tertiary of North America. Neotropical families of mammals are generally old Nearctic groups, older than the Holarctic and cosmopolitan families, which have arisen subsequently, and tend to displace their predecessors. Probably these relations would appear equally prevalent in the sub-mammalian groups of animals, and in the plants, if we knew their past history better, or if the correct interpretation were placed upon the distributional data of their existing representatives.

A full description with figures will be published later.

56.9,72: 14.98,27

Article XXI.—ABSENCE OF THE POLLEX IN PERISSODACTYLA.

By William Diller Matthew.

So far as the writer can discover there is no valid evidence for the presence of a pollex in any perissodactyl, living or extinct.

It is quite true that the pollex has been repeatedly recorded as present in descriptions of extinct Perissodactyla. In only one instance has the bone itself been identified and in this case the identification is certainly incorrect; in all others the conclusion rests upon the presence of a facet upon the inner side of the second metacarpal, supposed to be for the first metacarpal, but not so in fact.

Imprimis, there is no trace of pollex in any modern perissodactyl. The tapir, which has four fully developed digits on the manus, shows no trace of the first digit. The trapezium is present in most Perissodactyla; even in the horse a vestige of it is seen in some individuals.[1]

Among the Artiodactyla the pollex is present in *Ancodon, Oreodon, Agriochœrus* and probably in some other primitive extinct forms. It is well developed in the subungulate orders, in most unguiculate orders and in nearly all Primates, most edentates, etc.

In order to appreciate the evidence properly, a few words must be prefaced as to the relations of the trapezium, and pollex when present, to the remainder of the carpus. The primitive relations for the placental mammals are presumably shown in the Eocene and Paleocene Mammalia; the relations in all later mammals are specializations from these.

In the creodonts (excepting the later Mesonychidæ) the pollex is well developed. The trapezoid is small and rests upon mc. II. The trapezium is considerably larger, with a proximal facet for the scaphoid and a lateral facet which abuts against the trapezoid and the upper end of the mc. II; distally the trapezium rests upon mc. I which is more or less divergent and does not touch mc. II.

In *Phenacodus* the first digit is less divergent and mc. I is in contact with mc. II, although no distinct facet is developed. In *Ectoconus* and *Pantolambda,* commencing the subungulate series, the first digit is somewhat divergent, and mc. I articulates with the trapezium only, having no facet for mc. II; nor does such a facet develop in any subungulate manus so far as I have examined.

---

[1] Chubb, S. H., 1912, Bull. Amer. Mus. Nat. Hist., Vol. XXXI, p. 113.

In the earliest primates the pollex is larger and strongly divergent, largely opposable although not so fully as in the higher primates. In the earliest rodents (*Paramys*) the pollex is very short and small, mc. I has no facet for mc. II, but in some of the later rodents the reduction of the trapezium brings the two metacarpals into closer relation and a definite facet develops.

The same holds true in many modern Carnivora, the trapezium standing as a wedge separating the two metacarpals, but where, as in bears, the pollex has lost its divergence it develops a definite facet for mc. II.

In *Didelphis* and other primitive marsupials the manus has a strongly divergent, partly opposable pollex, and this may represent an earlier stage, from which the divergent or slightly opposable condition prevalent in primitive placentals is derived. Proof of this, however, is not at hand; all that we can properly conclude from the evidence, of which a few salient points are mentioned above, is that the primitive manus among the placental mammals had a partly divergent pollex, with large trapezium overlapping the head of mc. II and completely separating it from mc. I.

In *Ancodon, Oreodon* and *Agriochœrus,* which, although not the earliest Artiodactyla are the most primitive known genera with respect to the reduction of lateral digits, the pollex is small, and somewhat divergent, the trapezium overlaps the head of mc. II, and completely separates it from mc. I which is articulated only with the trapezium (except in *Ancodon,* fide Scott).

Among extinct Perissodactyla, we may consider first the Equidæ.

Marsh in 1876 reported the presence of the pollex in *Eohippus.* The statement was based upon fragments of the manus and pes in *E. pernix* from Black Buttes, Wyoming. Upon examination of Marsh's specimens by Mr. Granger and myself, permitted through the courtesy of Professors Schuchert and Lull, it was evident that Marsh had made this statement because of the presence, upon a fragment which he had identified and marked as the head of mc. II, of a lateral facet for another metacarpal. The bone is, however, the fourth metacarpal of the opposite side if I recall correctly; at all events it certainly is not mc. II. Consequently there is no evidence here. In the finely preserved manus of *Orohippus* in the Yale Museum there is certainly no first metacarpal. In the manus of *Eohippus* ("*Protorohippus*") *venticolus* in the Cope Collection, it appears to be absent. In other specimens of *Eohippus* collected by Mr. Granger the complete absence of the pollex is clearly demonstrated. It is certainly absent in *Mesohippus* and *Miohippus.* In early studies by Gidley and myself on the Miocene genera of Equidæ (1898–1901) we believed that we had found evidence for the existence of a small vestigial mc. I in *Merychippus* ("*Proto-*

hippus") from the Miocene of Colorado, again in the form of a lateral facet on mc. II; the trapezium in this genus is a small nodule with two facets which joined at a right angle, one of them conforming to a corresponding facet on the trapezoid, the other supposed to be for the head of mc. I. This evidence, fortunately, remained unpublished.

In 1903 Mr. Gidley in articulating the very perfect skeleton of *Hipparion whitneyi* identified as mc. I a small nodular bone very similar to the trapezium. The demonstration appeared therefore to be complete that in this far advanced equid a vestige of mc. I was retained, although it was absent in the Oligocene and Eocene Equidæ!

In the course of studies upon numerous specimens of the manus of Miocene Equidæ belonging to many species I observed several in which the trapezium was present but could never find any mc. I. It appeared moreover that the trapezium if accurately fitted to the carpus had been placed upside down by Gidley and myself; that its two facets were for the trapezoid and scaphoid, and that there was none for a mc. I. Nevertheless there remained the little facet on mc. II unaccounted for; it might well be for a vestigial mc. I that had lost its connection with the trapezium — although as might be inferred from the conditions among other placentals, the ordinary course of reduction does not in any instance follow that procedure.

Upon examining the supposed mc. I in *Hipparion whitneyi* it appeared moreover that it was not merely similar to the trapezium but identical; it was in fact the trapezium of the opposite manus.

Study of the flexed position of the carpal bones solved this puzzle. It appears that in flexure of the wrist the scaphoid pushes the trapezium downward, displacing it from its position upon the trapezoid and forcing it down upon the head of mc. II, where it fits well upon the small lateral facet and against the scaphoid above. The accuracy of these articulations of the trapezium in the extended and flexed manus was unmistakable. No one with much practical experience in the articulating of skeletons fossil or recent would, I believe, have any doubt whatever that this is the correct solution. The trapezium therefore in these Equidæ occupies two positions and has two articular connections, one with the trapezoid in extension, the other with mc. II in flexion, the former also serving the scaphoid in flexion. This facet on mc. II for the trapezoid is not present in the Oligocene and Eocene horses because on account of the difference in proportions of the carpal bones the trapezium is not pushed down by the scaphoid in flexure to a contact with mc. II beyond the small proximal facet that it has in extension. It is not present in *Equus* because on account of the extreme reduction of the trapezium it does not reach the metacarpal at all. It is not present in rhinoceroses because the carpus is not capable of the sharp flexure necessary to bring about this relation.

It appears therefore that at a certain stage in the evolution of the manus in the Equidæ the relations of the disappearing trapezium to the progressively more broad and quadrate scaphoid became such that it occupied two distinct positions on the inner side of the manus, one internal to the trapezoid the other internal to the head of mc. II, and was provided with a distinct facet on each bone.

In other Perissodactyla the following are the principal data:

In *Hyrachyus* there is no trace of mc. I. The trapezium is in form characteristically like the trapezium of the Equidæ, only less reduced; it has facets for scaphoid and trapezoid in extension and in flexion is pushed down over the head of the second metacarpal where it occupies a distinct although small facet. In *Trigonias, Cœnopus, Diceratherium, Aphelops* and *Teleoceras* the form is somewhat similar, but the trapezium relatively smaller, and has no facet on mc. II.

In the modern tapir the trapezium is small, but it takes more part in the supporting of the limb than in any other perissodactyl. It rests partly upon the proximal end of the second metacarpal, aiding the trapezoid in the support of the scaphoid, and is not excluded from the supporting series of carpals as in the preceding genera. It is larger in *Protapirus,* but its form and relations are much the same. Whether this is secondary, after the manner of adaptive reduction as observed in other carpal bones, or is its primary relation, cannot be determined from the known fossils. There is no trace of mc. I and no lateral facet on mc. II for the trapezium in flexed position. It would seem that in the tapirs, as in the rhinoceroses, the carpus is incapable of the sharp flexion of the later Equidæ, and the trapezium is not pushed down far enough to press against mc. II below its head.

In *Lophiodon* Deperet has announced the presence of a pollex, again upon the evidence of a small lateral facet upon mc. II, the bone itself not being known. It is probable that the conditions in *Lophiodon* were like those in *Hyrachyus,* a rather near relative, in which this facet is present but is for the reception of the trapezium in flexion, and not for any vestige of mc. I which is certainly not present. There is clearly a lateral facet on mc. II in *Colodon,* but the character of the trapezium is unknown.

The same conclusion, based upon the same evidence has been published in regard to *Schizotherium,* an early Oligocene chalicothere. In *Moropus* there is certainly no trace left of the first metacarpal. Nor is there any indication of a lateral facet on mc. II of the much more primitive *Eomoropus* of the Middle Eocene. Holland has based a subfamily distinction, between *Moropus* on one hand and *Schizotherium* and *Eomoropus* on the other, upon the supposed presence of a vestigial pollex in the two latter genera. The arrangement would be highly artificial even if the supposition were correct, but the evidence for the presence of mc. I in *Schizotherium* does not appear to be valid, and there is absolutely no reason to suppose that it was present in *Eomoropus*.

There is no pollex in any of the Titanotheriidæ, so Dr. Gregory assures me.

In sum, after examining all the evidence for the presence of a pollex in Perissodactyla it appears reasonably certain that it had wholly disappeared from the order at the time when we first meet it, in the Lower Eocene. The unknown Cretaceous ancestors of the order doubtless possessed a pollex, but whether they were perissodactyls in any definable sense may be doubted. More probably they would fall within the order Condylarthra. At all events, the absence of pollex is diagnostic of all known perissodactyls, living or extinct.

Finally it is necessary to call attention to two points of general application among fossil mammals.

1. The absence of a lateral (internal) facet on mc. II does not indicate absence of the pollex, since mc. I when present is more often divergent and not in contact with mc. II.

2. The presence of a lateral (internal) facet on mc. II does not prove the presence of the pollex, since it is frequently present in forms that have no mc. I, and serves for the accommodation of the trapezium in extreme flexure of the carpus.

Failure to appreciate these two points has led a number of able palæontologists to unwarranted conclusions with regard to presence or absence of the pollex, and to equally unwarranted deductions regarding the phyletic relations of various mammalian genera and species.

59.88.1M(8)

Article XXII.— FIELD NOTES ON *MOLOTHRUS BONARIENSIS* AND *M. BADIUS*.

By Leo E. Miller.

Introduction.

The American Museum of Natural History's recent expedition to Bolivia and northwestern Argentina acquired information about the breeding habits of various species of birds; and as comparatively little is known of the nesting of birds in South America, it has been deemed advisable to present these observations.

Among the material at hand is a collection of about 1200 eggs, a large number of nests, together with field notes on these species and other birds, taken by the writer, Mr. Howarth S. Boyle who was my constant companion during the last two years of South American field work, and Mr. Pablo Girard, a well-known naturalist of the Province of Tucuman, Argentina.

Unfortunately, the amount of time heretofore available for taking field notes has been comparatively limited; consequently the data available are correspondingly meagre. However, rather than withhold the information it has been possible to obtain until anything like the complete life histories of a number of species has been secured, it has seemed advisable to offer our observations as opportunity permits, even though they are comparatively fragmentary.

An examination of the material collected shows that a large part consists of notes on the breeding habits of several species of the genus *Molothrus* in the Argentine Republic; and while many observations have been recorded from that country, principally by Hudson, the present notes tend to throw additional light on the interesting habits of these birds. It has therefore been decided to present them in a separate paper, the first of a series, it is hoped, on the life histories of South American birds.

Leaving Sucre, the former capital of Bolivia, on December 22, 1915, the expedition proceeded southward over the high Andean plateau ranging in altitude from 9000 to 12000 feet above sea level, toward the Argentine frontier. After riding for twelve days, the three hundred miles had been covered and we reached Laquiaca, a small village on the Argentine side of the border. The journey was almost immediately continued by railway to Rosario de Lerma, in the Province of Salta, and only one hour's time by train from the city of Salta. This place was reached January 6, and was the first base from which collections and observations were made.

Rosario de Lerma is a pretty town with about one hundred buildings, nestling in a wide, level tract of fertile land. All about are fields of alfalfa, maize and vegetables, pastures, and patches of brush with an occasional clump of rather low, gnarled trees. There is no tall, dense forest in the vicinity. Some of the land is marshy and covered with a thick growth of shrubbery and thorny bushes. Naturally, this type of country is very favorable to the existence of bird life, and our first visits to the rural regions revealed a wealth of material for study.

The rainy season was coming to a close, and apparently bird nesting was nearly over. This correlation of the winter or rainy months with the nesting season of birds is a subject that offers a vast field for study.

Molothrus bonariensis bonariensis (*Gm.*).

Tanagra bonariensis Gm., Syst. Nat., I, ii, 1788, p. 878. "Bonaria."

Molothrus bonariensis Cassin, Pr. Ac. Sc. Phil., 1866, p. 19; Hudson, P. Z. S., 1872, p. 809, and 1874, pp. 153 et seqq. (Buenos Aires); Berlepsch, Journ. f. Orn., 1873, p. 249 (Santa Catharina); Durnford, Ibis, 1877, pp. 33, 174 (Chupat); Gibson, Ibis, 1880, p. 14; White, P. Z. S., 1882, p. 601 (Argentine Republic); Döring, Exp. al Rio Negro, Zool., p. 41 (Carhue); Barrows, Bull. Nutt. Orn. Club, VIII, p. 133 (Entrerios); Scl., Cat. B., XI, p. 335; Reed, Revista Chilena de Historia Natural, Año XVII, No. 3.

Description.— Male: uniform glossy purplish black, except on the wings and tail which have a pronounced greenish sheen. In specimens with old and worn plumage the glossy purple and the greenish colors disappear, leaving a brownish appearance, particularly marked on the wings and tail. Bill and feet shining black.

Female: Dark ashy brown; paler underneath, sometimes with a yellowish tinge; throat pale grayish, running to almost white at the base of the mandible.

Measurements of Males.

Locality	Wing	Tail	Bill
Rosario de Lerma, Argentine Rep.	113.5	82.5	19
" " " " "	114	82	19
Sarmientos, " "	109	78	19
Buenos Aires, " "	115	83	19
" " " "	112	77	19
Vinto, Bolivia	121	92	20
Mizque, "	116	85	20
" "	118	85	20
Rio Cachimayo, Bolivia	118	86.5	19

Measurements of Females.

Locality	Wing	Tail	Bill
Rosario de Lerma, Argentine Rep.	100	70	17
" " " " "	99	70	18
" " " " "	106	76	18
Bolivia, Buenos Aires	98	67	17
Mizque, " "	105	79	18
Rio Cachimayo, Buenos Aires	104	78	18
Rio Pilcomayo, " "	104	76	18

The males are somewhat larger than the females, and specimens from Bolivia average larger than Argentina birds.

Range.— Distributed through practically the whole of Argentina, including Patagonia. Its range also includes Uruguay, Bolivia, Brazil and Paraguay. It has been reported from the various provinces as follows: Chubut (Durnford); Rio Negro (Hudson); La Rioja (Koslowsky); Catamarca (Fontana); Salta (Borelli); Cordoba (Schulz); Tucuman (Lillo); Pilcomayo (Kerr); Chaco (Venturi); Buenos Aires (Venturi); Entre Rios (Barrows); Mendoza (Reed).

Apparently *Molothrus bonariensis* is not a bird of the high mountains in the Argentine; but in Bolivia (Pulque, between Sucre and the Rio Pilcomayo) it was not uncommon at an elevation of 9400 feet; but wherever I have found the bird it has always been near more or less well-defined river valleys where there were cultivated fields and pastures.

During the height of the breeding season, from October to February in the Argentine, the birds are scattered fairly evenly over any given district, spending the days in an apparently happy, care-free existence in the trees, or feeding in the pastures and fields. At night they resort to the taller trees to sleep.

After the domestic duties of the year are over, the birds congregate in large flocks to spend the winter months. In the Province of Tucuman we found them moving (May, 1916) to the rice-growing and marshy districts in the southwestern part of the province.

May 17 to June 3 found us in camp a mile from the railroad station of Los Sarmientos, near the base of the Andean foot-hills. A number of streams, fed by the rain and snow falling almost daily on the high peaks, rush down the steep mountainside and reaching the level plain, form a chain of lakes, marshes and bogs. Dense masses of *totoras,* or cat-tails, grow in the marshy areas, and the wet, surrounding country is sowed in rice. It is to this region that the Cowbirds revert, arriving in comparatively small flocks, but increasing in numbers until there are tens of thousands.

As the grain is ripening about this time, the birds do an enormous amount of damage in the rice-fields. All day long, men on horseback ride back and forth through the fields, armed with slings and a bag full of pebbles; they hurl stones and shout themselves hoarse in a vain endeavor to frighten away the marauding hosts.

The birds, in bands of a few individuals to several hundred, arrived each morning at day break, flying low and swiftly, and making a 'swishing' sound as they cut through the air. When immediately over the rice-fields, the band would suddenly swerve as if to circle, but drop almost instantly and eat greedily without a moment's delay. Upon seeing a flock approach the men threw stones and shouted, often succeeding in making it pass straight over or leave the vicinity after circling once or twice. Should the birds alight, the hail of stones soon put them to rout, but not until a few grains of the much coveted rice had been secured by each individual.

As the day advanced the birds spread out over the surrounding country where they were not persecuted, and spent most of the time on the ground near the cattle and horses, often perched on the backs of the grazing animals. At nightfall they returned to the cat-tails, and in passing over the rice-fields again took toll from the planters. The flocks in the marshes assume tremendous proportions, and the babble of voices resembles a rushing wind; the roar of wings, if the masses are suddenly startled by the report of a gun, is not unlike the roll of distant thunder. Before finally settling down for the night they spend some time hopping about on the mud-flats and eating minute animal and vegetable matter.

Carlos S. Reed, F. Z. S., Director of the Natural History Museum, Mendoza, Argentine Republic, gives the results of his investigations as to the food of *Molothrus bonariensis* in a paper in the 'Revista Chilena de Historia Natural, Año XVII, No. 3, 1913. The following is a translation, as literal as possible, of a part of the original paper, which is written in Spanish.

"In the summer of 1910 there occurred in various departments of the Province of Mendoza, a great invasion of *Isocas* (larvæ of a lepidoptera) and in various inspections which I realized in the infected countryside, I was able to confirm that a number of birds occupied themselves in eating the larvæ and adults of these *Isocas* (*Colias lesbia* Fabr.), and among them *Molothrus bonariensis* predominated.

"It is also a voracious destroyer of the white worm (larva of *Ligyrus bidentulus* Fairm) when these are exposed in plowing furrows in the vineyards. The '*bicho de cesto*' (*Æceticus platensis* Berg) is also very much persecuted by the bird with which we are occupied.

"The corn fields suffer damages by reason of *Molothrus bonariensis*, but only during the period between the beginning of the ripening of the ear and its collection; certainly, one ought not to take this damage into consideration, when during eleven months *Molothrus bonariensis* has fed in the cultivated country, on other products, not on maize, and among these has predominated the larva of *Chloridea armigera* (Hubn.), the most formidable enemy of the maize fields.

"I have examined the stomach contents of more than sixty specimens of *Molothrus bonariensis,* freshly shot, and always, in the various seasons, I have encountered about 90 per cent. of substances of animal origin and the rest of grains, principally of maize, but the maize they have generally obtained from the offal of horses and mules, as in Mendoza a good deal of maize is given to working animals, and as the grain is fed entire, a good per cent. is eliminated without having been digested. It is for this reason that one frequently finds *Molothrus bonariensis* scratching among and turning over the droppings. This custom is the reason for its having been given the common name of 'Vira-Bosta' in Brazil. For this reason *Molothrus bonariensis* may be looked upon as a bird helpful rather than destructive to agriculture."

Molothrus bonariensis bonariensis AT ROSARIO DE LERMA.

The commonest species of Cowbird in the vicinity of Rosario de Lerma is *M. bonariensis,* referred to by the Spanish speaking people as the "Tordo," although the bird usually called the Tordo is a species of Oriole, highly valued as a cage bird on account of its not unmusical singing ability. We saw flocks of them daily (month of January, 1916) in the fields, on the backs of cattle grazing in the pastures, in the courtyards of houses, in corrals, and more particularly in the scattered trees which were almost certain to contain at least one nest of the Ovenbird (*Furnarius*) or of some species of *Synallaxis.* Usually the flocks were composed of from ten to twelve individuals, the bright, glossy males outnumbering the dull, grayish females in the proportion of four to one. Azara gives the proportion of males to females as ten to one, but this disparity is too great for any part of the Argentine known to me.

The birds are noisy, keeping up a loud chatter, especially when a flock is on the wing, or when preparing for the night's sleep. The male bursts into a short, pretty song with frequency, dropping his wings and moving about in a nervous manner while singing. Apparently the female does not sing.

It has been said that the females of this species lay eggs during a period of three or four months; to know how many are laid by a single bird would be interesting, as the number must be very great in order to make allowance for the incalculable numbers that are wasted, and still provide enough to keep the ranks of the multitudes at their normal level.

We did not find a single egg of *M. b. bonariensis* on the ground, although Hudson states that in the vicinity of Buenos Aires these birds "frequently waste their eggs by dropping them on the ground." [1]

Dropping the eggs on the ground might entail a deliberate waste, as we know of no reason why the bird should suppose that they would be hatched and the young reared, if scattered broadcast over the country. On the other hand this might merely indicate that the birds had found no suitable place in which to deposit their eggs. The form of waste caused by the birds laying in old, disused nests, or by laying such a large number of eggs in a single nest that it is impossible for the rightful owner to incubate them and rear the young, can hardly be said to be deliberate, as it is doubtless caused by a lack of intelligence; if the bird designedly scatters its eggs broadcast on the ground, it is wantonly wasteful; if it merely lays in disused nests, or overcrowds nests actually occupied, the bird may simply be stupid.

It would be impossible to say what percent. of eggs laid by this species of Cowbird is wasted. Hudson estimates that each female lays from sixty to one hundred eggs in a single season, and it does not seem to me that this statement is an exaggeration. One female which I dissected had laid three eggs within the few preceding days, and a fourth was almost ready to be deposited.

The bird which suffers most from the parasitic habits of the Cowbird in the vicinity of Rosario de Lerma, is the Ovenbird (*Furnarius rufus*); however, of the great number of eggs laid in the nests of the above named species, our observations tend to show that the greater part are lost. Among the scores of Ovenbird nests which we examined, only two were still occupied by the owners, the desertion being apparently due to the invasion of the Cowbirds. So persecuted were the Ovenbirds that it is difficult to understand how any of them survived in this immediate locality. The nests were common enough, it being not unusual to find several of them in a single tree, but the birds themselves were not abundant. It is possible that some of the pairs may have built several nests each in their vain attempts to escape the attentions of the Cowbirds.

In no instance had the walls or top of the Ovenbirds' nests been broken or perforated in any manner, in order that light could penetrate to the interior; they were not tampered with in any way, and the Cowbirds seemed content to use them just as the Ovenbirds had constructed them.

---

[1] Argentine Ornithology, Sclater and Hudson, Vol. I, p. 74.

I believe that the greater number of *M. bonariensis* that reach maturity are reared by the smaller birds, such as *Poospiza, Brachyspiza, Geothlypis,* etc., in whose nests only a few eggs are laid, which increases the favorable chances of their incubation. Also, the larger and heavier eggs of the Cowbird frequently crush at least a part of the smaller eggs which naturally have a more fragile shell, thus forstalling to a marked degree the competition which might arise between the young birds in the nest.

List of Species parasitized by M. bonariensis.

In the course of his several papers on *Molothrus bonariensis*, Hudson mentions the names of the following species as having been parasitized by this species:

Muscivorora tyrannus
Pseudoleistes virescens
Sisopygis icterophrys
Sporopophila cærulescens
Hapalocercus flaviventris (?)
Serpophaga sp.
Troglodytes sp.
Mimus sp.
Anthus correndera
Sturnella sp.
Polioptila dumicola (?)

White (P. Z. S., 1882, p. 601) gives the following:
Troglodytes musculus

Gibson, Ibis, 1880, p. 15.
Brachyspiza capensis
Troglodytes musculus
Furnarius rufus
Pseudoleistes virescens
Planesticus rufiventris
Spinus barbatus
Leptasthenura ægithaloides
Progne tapera
Lichenops perspicillata
Muscivora tyrannus

Reed, Revista Chilena de Historia Natural, June, 1913.
Sicalis arvensis arvensis
Pseudochloris aureiventris
Brachyspiza capensis capensis
Trupialis militaris militaris
Anthus correndera
Mimus triurus
Mimus patagonicus
Saltator aurantiirostris
Diuca diuca
Pitangus sulfuratus bolivianus
Elaenea albiceps

Girard, Province of Tucuman, Argentina.
Planesticus rufiventris
Planesticus leucomelas
Saltator cærulescens
Saltator aurantiirostris
Thlypopsis sordida
Thraupis bonariensis

Thraupis sayaca
Pheucticus aureiventris
Cyanocompsa cyanea argentina
Brachyspiza capensis
Cyclarhis viridis
Vireosylva chivi
Furnarius rufus badius
Geothlypis equinoctialis cucullata
Pitangus sulfuratus bolivianus
Tyrannus melancholicus
Paroraria cuculata
Poospiza melanoleuca
Thamnophilus major
Mimus patagonicus
Empidonomus aurantio-atrocristatus
Molothrus badius
Saltatricula multicolor
Myiodynastes solitarius
Sisopygis icterophrys

In the vicinity of Rosario de Lerma we found eggs of the species in question in the nests of the following species:

Brachyspiza capensis
Thraupis bonariensis
Furnarius rufus
Poospiza whitii
Poospiza melanoleuca
Geothlypis aequinoctialis cucullata
Fluvicola albiventris, at Embarcacion.
Mimus saturninus modulator, at Tilcara.

Eggs of Molothrus bonariensis.

Of the nearly 200 eggs of this species before me, nearly all of which were collected at Rosario de Lerma, a great variation in marking exists, and there is also some difference in color. As a general rule the eggs are greenish or bluish, rather heavily spotted with reddish-brown; in a very few specimens the background is of a pale flesh-color, and in a small number of others it approaches white, having however a dull grayish tinge; of the entire lot, four only are so lightly marked as to appear unspotted. Not a single egg is pure white or has a pure white background (my standard of comparison is an egg of *Furnarius*) "like the eggs of birds that breed in dark holes"; the majority of these eggs were taken from the darkened interiors of Ovenbirds' nests, and not in a single instance was the nest broken in any way to permit the entrance of light.

A type of egg not uncommon is heavily and evenly marked all over with fine dots and larger spots of reddish-brown. Judging from the material at hand I should say that there is a characteristic type of marking running through the eggs of the species if we except the two extremes, viz., those almost unspotted, and those so entirely covered with heavy blotches that they appear to be of a uniform chocolate color.

However, the eggs of each individual seem to vary in some respect from those of any other, as it is impossible to find two exactly alike in comparing series from different places. Frequently, two or more eggs found in the same nest resemble each other so closely in size, shape and coloration, that I think it is reasonably safe to say they were laid by the same bird.

The shape of the eggs is ovate or rounded ovate. Average size of 20 typical specimens, 24.87 × 19.74 mm. Largest egg available, 26 × 21.5 mm.; smallest, 23.75 × 19.25.

Nesting Records.

A list of the nests discovered containing eggs of *Molothrus bonariensis* is given below, together with the number of eggs found in each. All but the last three records are of nests found at Rosario de Lerma. On account of lack of time it was impossible to make a thorough investigation of the region or to examine all nests which we observed; but the results of our observations herewith presented will, I believe, throw a good deal of additional light on the breeding instincts of the bird, and particularly upon the number of eggs laid in one nest. In some instances the number was so large that it is hard to believe that there was not some abnormal influence prevailing to stimulate an unusual production.

Jan. 8. *Brachyspiza capensis.* Nest on the ground, among the grasses. Contained one fresh egg of the sparrow, and 2 cowbird eggs; the latter differed greatly, apparently indicating that they had been laid by two individuals.

Jan. 9. *Brachyspiza capensis.* Nest in a bush about six feet above the ground; contained 2 eggs of the owners and 1 cowbird, all fresh. The latter is of a beautiful pale blue color with only a few minute dots which are barely visible.

Jan. 9, *Poospiza* sp.? Nest in a bush, 5 feet up; 2 eggs of the finch, one of which was pecked full of holes, and 1 of the Cowbird. The nest had apparently been deserted as there were no birds around it and all the eggs were addled.

Jan. 10.— *Thraupis bonariensis.* Nest in clump of mistletoe, 6 feet up; contained 2 eggs of the owners with incubation advanced, and three eggs of *M. bonariensis,* one with incubation advanced and two addled. The five eggs filled the nest and it was doubtless impossible for the bird to cover all of them.

A second nest of this species discovered the same day was in the top of a vine-covered sapling, 7 feet up, and contained one young tanager and one young cowbird. Apparently both were newly hatched, but the latter was twice the size of the former and a good deal more active. The nest also contained two cowbird eggs, one fresh and one with incubation advanced.

Furnarius rufus. Nest on the branch of a low tree; contained 2 eggs of the cowbird and two young ovenbirds about ready to leave the nest. One of the eggs was fresh, the other partly incubated.

Jan. 11.— *Furnarius rufus.* A deserted nest was examined which contained 4 addled cowbird eggs besides the shells of a number of others which had become broken.

Jan. 12.— *Poospiza whitii.* In the small nest, made of grasses and placed in a tangle of pumpkin vines, there were 3 eggs of the finch and 1 of the cowbird; incubation was advanced in all except one of the finch eggs, which had been pecked full of holes.

Furnarius rufus. Nest on the branch of a tree 15 feet up. It contained 15 eggs of *M. bonariensis,* two of which fell out when I opened the nest, so only 13 were saved. Of these, one was fresh, the others spoilt. The eggs were in several layers with thin grass partitions between; apparently the ovenbirds had deserted the nest after making several ineffectual attempts to cover them up. A number of cowbirds were singing in the tree and hovering about the nest.

Furnarius rufus. Collected by H. S. B. The mud nest was 12 feet up. It contained 26 cowbird eggs, 11 of which were fresh. As in the foregoing nest, they too had been placed in layers, and the lower ones covered with grass. Some of the eggs seemed to have been laid several weeks before, and 6 were slightly crushed; it was however possible to blow 22 of them.

Jan. 13.— *Furnarius rufus.* Nest 14 to 15 feet up. Contained 1 egg of the ovenbird and 6 of cowbirds, all fresh, but apparently the nest was deserted by the owners, and the *Molothrus* had taken full charge. Of the 6 eggs, 4 had apparently been laid by one bird and 2 by another.

Another nest of the same kind contained 1 ovenbird and 4 cowbird eggs, all of them more or less fresh. Judging by the size, shape and coloring of the cowbird eggs, they had been laid by three different individuals.

Jan. 14. Nine nests of *Furnarius rufus* were examined on this date. Of these seven were empty, but bore evidences of having been used earlier in the season. One of the remaining two contained 9 cowbird eggs, 8 being of *M. bonariensis,* and 1 apparently of *M. rufoaxillaris;* two of the eggs were badly crushed, but the remaining seven were fresh. The 6 eggs of *M. bonariensis* appear to have been laid by three different individuals, two eggs by each.

The other nest contained 25 cowbird eggs, of which 14 were fresh, although it was possible to preserve 23 of the total number. They were piled in the nest without any special arrangement, and none of them was covered with nesting material. A large flock of *M. bonariensis* and a number of *M. rufoaxillaris* were in the tree in which the nest was located, singing and fluttering about, and showed great uneasiness when the structure was approached. Of the 23 eggs preserved, I think 2 may be referred to *M. rufoaxillaris* and 21 to *M. bonariensis.* While I believe that it is impossible in every instance to identify the eggs of each individual cowbird by its size, color pattern and form, I nevertheless think that in the majority of instances one does not go far astray in using these three criterions in determining how many of the eggs found in the same nest were laid by a single bird. Of the 23 eggs before me, it seems as if there are two 'sets' of 4 eggs each; four of 2 each; and 5 single eggs; also the 2 single eggs of *M. rufoaxillaris.* From this I conclude that no less than 13 different individuals laid in this single nest.

Jan. 15.— *Poospiza whitii.* Nest in a small bush, 18 inches up. Contained 2 eggs of the owners and 1 of *M. bonariensis.* Incubation was well advanced in all of them.

Furnarius rufus. Nest collected by native assistant; he said that it contained about 20 eggs although he broke all but 12 in falling out of the tree. The 12 eggs were all addled, and seem to represent the product of 5 different birds, as follows: — 1 set of 4; 1 of 3; 2 of 2 each; and 1 single. Nest deserted.

A second nest of the ovenbird discovered on this date contained 2 eggs of *M. bonariensis.*

Poospiza melanoleuca. The nest of this interesting species was in a clump of bushes about 6 feet above the ground. It contained one egg of the finch and one of cowbird, both fresh.

Jan. 16. *Geothlypis æquinoctialis cucullata.* In a small grass nest of this species, placed at the base of a low bush, I found 3 eggs of the owners and 2 of the cowbird, all fresh. One of the warblers eggs had holes pecked in it.

Furnarius rufus. This nest, which contained the record number of eggs, was brought in by my companion, H. S. Boyle. It contained one egg of the ovenbird and 37 cowbird eggs. Of this number 5 were fresh, and the others in such bad condition that it was possible to save only 20 of the entire number. The eggs were in several layers, the lowest of which was covered with nesting material. No ovenbirds were seen in the vicinity of the nest, but a large flock of *M. bonariensis* was in the tree and about the nest when it was discovered.

Another nest, brought in by our native assistant, contained 1 ovenbird and 17 cowbird eggs, all fresh, so it was possible to preserve the 'set' intact. Three of the cowbird eggs had shells perforated with small holes. It seems probable that the 17 cowbird eggs were laid by 12 different birds, there being, apparently, two sets of 3 eggs; one of 2; and 9 single eggs. The boy, who during the eighteen months he was in our employ proved himself to be a careful observer, stated that the tree from which he took the nest was "full of *tordos negros,*" and that one of them was fighting with the ovenbird at the entrance of the nest.

Jan. 28. *Fluvicola albiventris.* Embarcacion, Chaco. Nest basket-shaped, made of fine grasses and lined with feathers. Placed in a bush about two feet above the water of a lagoon. Contained one egg of the fly-catcher and one of *M. bonariensis,* both addled.

Feb. 12.— *Mimus saturninas modulator.* Tilcara. Apparently a deserted nest, in the center of a large thorn bush, 3 feet above the ground. Contained 14 eggs of *M. bonariensis,* all addled; of this number it was possible to preserve 10, which seem to represent the product of 7 birds — three sets of 2 each, and four singles.

Feb. 10.— *Mimus saturninas modulator.* Tilcara. Nest made of grasses and placed in the old nest of a *Synallaxis,* in a cactus about 5 feet up. Three eggs of the owner and 1 of cowbird which somewhat matches the mockingbird's eggs in shape and coloration. Incubation advanced in all.

Molothrus badius (*Vieill.*).

Molothrus badius Burm., La Plata Reise, II, p. 495; Scl. and Salv., Nomencl. p. 37; Hudson, P. Z. S., 1874, p. 163; Durnford, *Ibis,* 1877, p. 174; Scl., Cat. Am. Bds., p. 135.

Description.— Male: Dull brownish-gray, paler underneath; wings chestnut. Tips of primaries, inner portion of secondaries, and tail blackish. Bill and feet blackish. The coloration of the female is similar.

Range.— Bolivia, Argentina and Paraguay.

Commonly called Bay-winged Cowbird. These birds are usually very abundant, and live in flocks of from half a dozen to twenty or more individuals, but congregate in immense numbers at night. They are found at much greater altitudes than *M. bonariensis;* at Cuchicancha, Bolivia (east of Cochabamba), alt. 11,000 feet, *M. badius* was one of the commonest birds, spending the days in the grain fields, and also in the freshly plowed areas. They were tame and unsuspicious, but if alarmed, uttered harsh cries as the flock took wing, and flew in a compact mass to a fence or bush a short distance away.

The whole region about Cuchicancha is naturally treeless; but a double row of willows, several hundred feet long, planted many years ago, furnishes protection for the birds during the cold nights. Large numbers of birds of many species seek this refuge at sunset, and among them the Bay-wing is one of the most abundant, arriving in small flocks until there are many hundreds of them in the tree-tops. Compared with the White-throats

(*Brachyspiza capensis*) with which they share the same trees, they are not very active, but spend a good deal of time sitting on the same branch, chatting and gesticulating with their neighbors.

Near Cochabamba, we found *M. badius* to be a very common bird; and while we were not fortunate enough to be in that vicinity during the nesting season, we were frequently told of the battles which take place between the Bay-wing and the Ovenbird (*Furnarius*) for the possession of the latter's nest. In these fights the Cowbird is said to be successful in the majority of instances, and often succeeds in killing his adversaries. The museum of natural history and the museum connected with the veterinary college in Cochabamba, have on exhibition small groups of the mounted birds, illustrating this pugnacious trait of character; and the Bay-wing is always shown as victor, standing over the bloody body of the Ovenbird. This may, of course, be an exaggeration, but I nevertheless think there must be a good foundation for the belief.

At Rosario de Lerma, Argentina, *Molothrus badius* was not nearly so common a bird as *Molothrus bonariensis,* and we found no nests until toward the end of the breeding season, that is, not until the end of February.

This species of Cowbird differs from the other members of the genus found in the Argentine in that, with possibly a few exceptions, it incubates its own eggs. However, the bird is so gregarious in its habits that it is not common for the flocks to remain together during the breeding season and for several females to lay in the same nest. The nests of other birds are frequently used, the rightful owners having in many instances been ejected by force.

Hudson speaks of the attacks of the Bay-wings on both the adult and young of the Leñatero (*Anumbius acuticaudatus*) with fatal results to the latter.

Eggs of Molothrus badius.

The eggs of *M. badius* are easily distinguished from those of *M. bonariensis,* by their smaller size and intense coloration. They are elliptical in shape and heavily marked with reddish-brown; frequently there is a scattering of short, thick lines of deep chocolate color or black on one of the ends or all over the eggs. Size of eggs, 23: 50 × 19: 50.

Nesting records of Molothrus badius.

Tilcara, Feb. 8, 1916. This nest, apparently built by *M. badius,* was placed in a hole in an adobe wall, 10 feet up. It was constructed of soft grasses only and merely formed a pad for the eggs. When discovered the nest contained 5 fresh eggs, and although it was under observation several days, no more were deposited. A flock of four or five Bay-wings was constantly in the neighborhood, and I on a number of occasions flushed one of them from the nest. As I approached the wall they always grew very much excited and fluttered about, with loud, resentful cries. Four of the eggs are very much alike, while the other is smaller and marked in a different pattern.

There were many similar holes in the wall (ruins of an old Indian dwelling) although no others were occupied. A few of the holes contained old nests, and in one of them I found three dead, nearly full-fledged young birds, apparently of *M. badius*. Numerous holes had also been excavated entirely through the wall which was about eighteen inches thick.

Tilcara, Feb. 10, 1916. Nest of *Mimus saturninus modulator*. The Mockingbird nest had been placed among the remains of a nest of a *Phacellodomus*, in the crotch of a cactus, several feet up. It contained five fresh eggs, two of them typical of *M. badius* and three that closely resemble the eggs of the Mockingbird, to which species they probably belong. Collected by our native assistant.

Rosario de Lerma — Feb. 20, 1916. Nest of *Furnarius rufus*, containing 10 fresh cowbird and 1 addled ovenbird eggs. The former are easily separable into groups, and seem to indicate that four females participated in laying in this one nest. Of *M. badius* there are 2 sets of 2 eggs each, and one set of 3 eggs. Then there are three eggs between which there is a great similarity but all differ greatly from any of the others; both in shape and color they somewhat approach the eggs of *M. rufoaxillaris*, but I am unable to definitely determine their identity.

A second nest of *F. rufus* contained one typical egg of the Bay-wing, addled.

Nest of *Phacellodomus rufifrons*. Collected by H. S. Boyle. The large, pear-shaped nest contained 17 eggs of *M. badius*, two of which were just hatching. Of the remaining 15 eggs it was possible to preserve 13 that ranged from fresh to partly incubated and addled. There is such a diversity in size and color in this lot that I am unable to say how many females probably used this nest, but evidences tend to show that there were not less than five. The eggs might be placed in loosely defined groups as follows: — One set of 4; one of 3; three of 2.

59.81 (75.6)

Article XXIII.— REPTILE AND AMPHIBIAN COLLECTIONS FROM THE NORTH CAROLINA MOUNTAINS, WITH ESPECIAL REFERENCE TO SALAMANDERS.

By Emmett R. Dunn.

Plates LVII–LXI.

Introductory note.— The department of herpetology of the American Museum was so fortunate as to be able to send Mr. Emmett R. Dunn, instructor in zoölogy at Smith College (now a volunteer in one of the Federal training camps), for field work in the mountains of North Carolina during the summer of 1916. Collections of amphibians and reptiles were made, especial reference in the work being given to salamanders, since this region is a famous center of distribution for this group and has many rare and peculiar species. Type localities were visited and 853 specimens of salamanders were collected, notwithstanding considerable interference in plans by floods which made localities inaccessible by the usual routes.

The collections contain large and very distinct series of toads of the two species *Bufo americanus* and *Bufo fowleri*, the former found at high elevations and low, the latter at relatively low elevations only, never above 2700 feet. A new turtle, a high altitude race of *Clemmys muhlenbergi*, was unexpectedly found. It was collected as high as 4200 feet. Complete larval series were obtained of *Spelerpes ruber schencki* and *Spelerpes guttolineatus;* several larvæ of the rare *Gyrinophilus danielsi* were found; the larva of *Leurognathus marmorata* is made known to science for the first time; large series of the three species of *Desmognathus* restricted to the southern Alleghenies come into the American Museum collections; and four species of *Plethodon* include a new form larger than *P. glutinosus*.

The illustrations, which give for the first time figures of many forms, both adult and larval, have been made by Mr. Makoto Nishimura under the supervision of the department.[1]

---

[1] This brief introduction and summary is prepared by the department, since Mr. Dunn was called away on military service.— M. C. Dickerson.

Narrative of the Trip.

The time of the collecting trip in the North Carolina mountains, carried out under the auspices of the American Museum of Natural History in 1916, may be divided into two parts; that spent at Brevard, and the stay at Pineola. Brevard is in Transylvania County, southwestern North Carolina, and all of our collecting in that neighborhood was done in that county. I was accompanied by Mr. Walter S. Nevin, of Haverford College. We reached Brevard on July 1. Thanks to the kindness of Dr. and Mrs. Wallis of that city, we were shown a good camping site, to which we went almost immediately.[1]

This camp was on a hill east of the town, flanked on two sides by the French Broad River and outlined by the roads from Brevard to the two bridges, of which the upper was known as Wilson bridge, and the lower as Elm Bend bridge. This hill was wooded and rose from the river low grounds at 2100 feet, to a little over 2400 feet. It had four small streams rising on it, of which the one that started at our camp spring and went some distance through the low grounds was the only one of any length. The others were on the sides of the hill, and on the low grounds immediately adjacent to it. On the lists of specimens the word "camp" refers to this hill as a whole.

We also collected for some distance in all directions around Brevard. East of the river the highest mountain was Rich Mountain, some 3700 feet in elevation. We took a trip to this and also to See-off, the estate of the Appalachian Club, farther up the river. Along the river itself we went as far as Pisgah Forest and Davidson River, the two stations next to Brevard. Back from the river on the west, we collected on Elk Lodge Mountain, between Pisgah Forest and Brevard, up King's Creek, which enters the river just below Brevard, on Cedar Rock Mountain, and along Cathey Creek which rises on its slopes and enters the river at Selica, the station above Brevard. A longer trip was taken to the Pink Beds Valley, the floor of which is 3200 feet, and from which the Pisgah Ridge rises to 4500 and 5000 feet. In the Pink Beds we met Miss Crystal Thompson, of the University of Michigan Museum, who also was collecting reptiles and amphibians.

---

[1] Dr. and Mrs. Wallis were extremely kind to us during our whole stay in Brevard, they did everything in their power to help make our trip a pleasure and a success, and I wish to take advantage of this opportunity to express my gratitude.

I should like also to state my appreciation of the help and companionship of Mr. Walter S. Nevin. He was the best possible comrade, with a sense of humor that counteracted rain and flood and bad luck. What success we had was in considerable part due to his help.

From Brevard we went to Pineola in Avery Co., North Carolina. This is at an altitude of 3800 feet. Grandfather Mountain, the highest in the vicinity, is slightly over 5300 feet. Most of our collecting here was done on a hill between Linville and the Grandfather, although a few specimens were taken between Pineola and Linville, and others in the valley of Lost Cove Creek between Pineola and Edgemont. Most of the neighboring country, however, save that around Grandfather, has been burnt over, and is covered with a scrubby second growth in which locust predominates. In this the salamanders are almost non-existent, and traveling is very hard.

The country owned by the Linville Company shows the primitive conditions of flora and fauna, and being rendered accessible by the splendid Yonahlossee Road, is a paradise for the field naturalist; while that to the other side of Pineola, on the east face of the mountains along Lost Cove Creek, is a dismal and almost impassable waste of cliffs and second growth locust, in which the evils of forest skinning and forest neglect are only too evident.

Habitat Associations.

There were in the vicinity of Brevard two very distinct faunal associations; that of the low grounds and that of the mountains. The dividing line between the two would be at about 2500 feet, although the mountain salamanders came down farther in the streams.

The low ground fauna was mainly Carolinian. Noticeable birds were the mockingbird, Carolina wren, Carolina chickadee, dove, and tit. Robins and wood thrushes were common. The king snake, Fowler's toad, the cricket frog, and *Spelerpes guttolineatus*, were characteristic of this fauna. The mountain fauna was characterized chiefly by its salamanders, although the milk snake appears to be restricted to it.

A table has been prepared which shows the relations more clearly, and gives for the low grounds the subdivisions as follows: rivers, streams, springs, ditches, swamps, fields, thickets, and woods. For the mountains the subdivisions are as follows: ponds, streams, springs, fields, woods, and "balds" or clearings on the tops or slopes of mountains. Asterisks denote species that occur in both faunas. Of course it must be realized that this arrangement is simply the one into which our specimens fall, and where we have but few records of a species the arrangement may not be indicative of its usual habitat preference.

Low ground faunal divisions.

	River	Stream	Ditch	Swamp	Spring	Field	Thicket	Wood
Cryptobranchus alleganiensis	×	×						
*Notopthalmus viridescens								×
*Plethodon glutinosus							×	×
*Desmognathus ochrophea carolinensis			×		×			
*Spelerpes ruber schencki					×			
“ guttolineatus			×		×			
* “ bislineatus			×		×			
Bufo fowleri				×		×	×	×
* “ americanus						×	×	×
Hyla versicolor				×				
“ pickeringi				×				
Acris gryllus				×				
*Rana clamitans		×	×	×				
* “ palustris		×	×					
“ catesbeiana	×							
Terrapene carolina				×		×	×	×
*Clemmys nuchalis			×	×				
*Plestiodon quinquelineatus								×
*Sceloporus undulatus						×	×	×
Natrix sipedon	×	×	×					
* “ septemvittata		×	×					
Lampropeltis getulus						×		
Heterodon platirhinos						×		
*Diadophis punctatus								×
*Carphophis amœnus								×
*Coluber constrictor						×	×	

Mountain faunal divisions.

	Pond	Stream	Spring	Field	Wood	Bald
*Notopthalmus viridescens	×				×	
Plethodon erythronotus					×	
" metcalfi					×	
" yonahlossee					×	
* " glutinosus					×	
*Desmognathus ochrophæa carolinensis					×	
" quadramaculata		×	×			
" monticola		×	×			
Leurognathus marmorata		×				
Gyrinophilus danielsi		×	×			
*Spelerpes ruber schencki		×	×			
*Spelerpes bislineatus		×	×			
*Bufo americanus				×	×	×
*Rana clamitans	×	×				
*Rana palustris		×				
*Clemmys nuchalis				×		
*Plestiodon quinquelineatus					×	×
*Sceloporus undulatus					×	
*Natrix sipedon		×				
* " septemvittata		×				
Thamnophis sirtalis					×	
Storeria occipitomaculata					×	
Lampropeltis doliatus triangulus				×		×
Elaphe obsoleta					×	
Diadophis punctatus					×	
Carpophis amoenus					×	
Coluber constrictor				×		
Agkistrodon contortrix						×
Crotalus horridus				×		×

Class AMPHIBIA.

Order CAUDATA.

Family CRYPTOBRANCHIDÆ.

1. **Cryptobranchus alleghenensis** (*Daudin*).

One young one, 180 mm. in length, was taken in Williams Creek, which runs into the east side of the French Broad, about a mile from the river and one quarter mile below Glen Canyon falls. We were seining for minnows at the time and the "water dog" was discovered by turning over a flat rock in a riffle.

Field No.	Am. Mus. No.	Locality	Alt.	Date
502	4504	Williams Creek	2100	Aug. 7

Family PLETHODONTIDÆ.

2. **Plethodon yonahlossee**, new species.

Plate LVII, Figs. 1–3.

Type: Am. Mus. No. 4634 (Field No. 542), collected near the Yonahlossee Road about 1½ miles from Linville, N. C., altitude 4200 feet, Aug. 16, 1916.

Diagnosis: Generally similar to *Plethodon glutinosus* (Green), but with much longer vomerine teeth rows, and with a chestnut red dorsal band from base of head to base of tail.

The dentition consists of two long, curved vomerine teeth in each, extending further beyond the choanæ than the width of the choanæ, separated posteriorly by ⅕ the length of the series, and from the parasphenoid by ¼ the length of the series. Parasphenoid patches confluent or separated by a narrow groove. The choanæ are large as in *glutinosus*. The teeth are somewhat smaller than in *glutinosus*. This dentition corresponds more closely with that figured by Stejneger for *Plethodon jordani* Blatchley than with that of any other Eastern *Plethodon*. The vomerines agree also with Cope's description of *P. croceater*. The vomerines of *P. glutinosus* are straighter with about 11 somewhat larger teeth.

The coloration of the belly is lighter than in *glutinosus* and darker than in *metcalfi*. It is however uniform as in these species and not mottled as in *erythronotus*. The throat is especially pale. The tail is distinctly bicolor and reminds one of the tail of *Peromyscus*. The whole surface, dorsal and ventral is sprinkled with tiny unpigmented dots as in *glutinosus, metcalfi,* and *shermani.* It lacks the larger spots of white ground color that are irregularly scattered over the belly of *glutinosus,* and which seem to mark the position of mucous glands. *Yonahlossee* has also those spots of white pigment found in *glutinosus* which overlie the black. These are more regular in their distribution than in *glutinosus,* being absent save on the sides and there rather crowded into a band of white. In the young of *yonahlossee* the black pigment is absent in a double series of dorsal patches, there being 4–6 patches in each row. The red of the whole dorsal surface shows much more brightly in these patches. In adults the back is uniformly covered with black pigment, but the red is visible as a dark chestnut patch covering the whole back from the base of the head to the base of the tail. It extends on the sides only as far as a line between the bases of the legs, the space on the sides between the bases of the legs being almost covered by the white pigment spots. Both red and white pigment fade to a great extent in preservation.

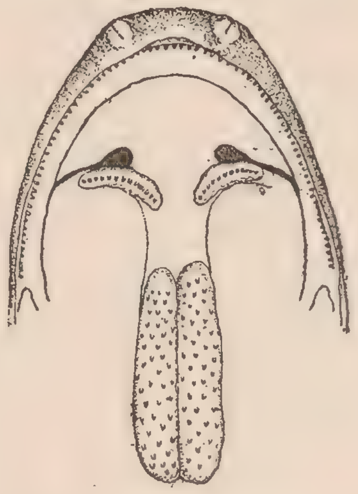


Fig. 1. *Plethodon yonahlossee,* No. 4634. Roof of mouth to show dentition. $\frac{2}{1}$.

This form cannot be considered an "*erythronotus* phase" of *glutinosus* for even if the dentition were the same, the red is visible still when the black covers the back. The difference between *erythronotus* and *cinercus* is solely the absence or presence of black pigment, the red being always present, but not visible as such save when the underlying black is absent.

One cannot avoid comparing these light patches on young *yonahlossee* with the unpigmented larval areas in *Spelerpes* and *Desmognathus.* It is probable that in these patches we have a reminiscence of a larval life. *Plethodon dorsalis* and *Plethodon erythronotus* have a band on the back similar to the patches of young *yonahlossee,* and comparable to the dorsal band of *Desmognathus ochrophaea carolinensis.*

The presence of a melanistic or *cinereus* phase of each is indicative of the loss of the teleological significance of these bands, the character probably Mendelizing.

The red legs of *P. shermani* and the yellow cheek patch of *P. jordani* are similar to the red back of *P. erythronotus* in that the black pigment is absent from these parts, but although these are probably remains of a primitive black-and-red or yellow coloration as in *Spelerpes* or *Desmognathus,* they do not retain traces of a pattern as do *yonahlossee, dorsalis,* and *erythronotus.* The color of *glutinosus* is that of *yonahlossee* minus the red and with white pigment spots on the dorsal surface. It is impossible to correlate the coloration of *P. æneus* with any of the above and it seems in other characters as well (the peculiar feet, the small choanæ) to be the most isolated of our eastern *Plethodons.* Among Western forms *croceater* and *intermedius* resemble *yonahlossee* and *erythronotus* respectively. *P. croceater* has also the red legs of *shermani. Glutinosus* and *yonahlossee* seem unique in the possession of white pigment spots.

The tail is as long or longer than the head and body. It may be slightly longer proportionally than the tails of *glutinosus* or *metcalfi.* It has a slimmer tail than *glutinosus,* but in other respects is quite as stout. The head is long entering the body 3.1–3.5 times. The same ratio in *metcalfi* is 3.3–3.7; in *glutinosus* 3.3–4.2. The head of the largest *glutinosus* is 16 mm. long, that of the type of *yonahlossee* is 19 mm. The appressed limbs overlap in young specimens, but in adults are separated by two intercostal folds. The costal grooves are 14, not counting one above the arm or one which is a bifurcation of the last. This is as in *glutinosus* and *metcalfi.* The feet and hands are as in *glutinosus.* The grooves of the side of the head, the gular fold, etc., do not differ from those of *glutinosus* and *metcalfi. Yonahlossee* is rather less slimy than *glutinosus.*

Yonahlossee is larger than *glutinosus,* a series of 25 ranging from 57–165 mm.; while a series of 80 *glutinosus* ranges from 42–159. Specimens below 65 mm. are apparently in their first year, being comparable to specimens of *glutinosus* and *metcalfi* below 50 mm. These specimens below 65 mm. have the light dorsal patches.

This species was taken only on a hill near Linville. All but one were taken on the upper side of the Yonahlossee Road.

In going from Linville to Blowing Rock, one passes a house on the left, about two miles from Linville. On the left between Linville and the house a wooded hill rises to about 4400 feet (the average altitude of the road is 4100 ft.). On this hill, and most of the time within sight of the road, we got 462 salamanders in three days' collecting, as follows:

Notopthalmus viridescens	44
Desmognathus ochrophæa carolinensis	135
Plethodon erythronotus	48
" *metcalfi*	150
" *yonahlossee*	23
" *glutinosus*	47
Spelerpes bislineatus	13
" *ruber ruber*	1

Under one strip of bark on the ground we found seven salamanders, two *N.*

viridescens, two *P. metcalfi,* one *D. o. carolinensis,* one *P. glutinosus,* and one *S. bislineatus.* It may be noteworthy that we never took *yonahlossee* in direct association with *glutinosus,* although it was found with *metcalfi* and *erythronotus.* It was much the most agile of the four *Plethodons* there. We failed to catch several very large specimens. They had burrows extending sometimes for several feet.

Glutinosus and *metcalfi* also had similar burrows. On turning over a log or a piece of bark if the *Plethodon* was near the entrance of its burrow, it simply let go all holds and dropped out of sight. If it was not near the entrance it ran for it, and we could usually head off the other three species but *yonahlossee* was often too fast. And when as occasionally happened two of them were under the same piece of bark one was all we could hope to get. Sometimes we dug open the burrows, but we rarely had success in catching the inmates.

I refer to this species two specimens in the U. S. National Museum, collected "between Linville and Blowing Rock," by Mr. Sherman. Brimley refers to these two as having red backs, and on the cloth field tags it is so stated. The red has long ago disappeared, but they are easily identified by the long head, peculiar dentition, and white throat.

A *Plethodon* (*P. wehrlei* Fowler & Dunn) having been recently discovered in the Pennsylvania mountains, which differs from *metcalfi* chiefly in having 17 instead of 14 costal grooves, the fact that a new one is described above, and the fact that many of the described forms are rare in collections and their descriptions scattered, have led me to add a tentative arrangement of the eastern forms.

Four characters seem to me to be indicative of more simple or primitive forms, other things being equal; (1) a low number of costal grooves; (2) a dorsal pattern; (3) a large number of vomerine teeth (4); large size.

In *Desmognathus* and in *Spelerpes,* both of which genera have a black and red or yellow coloration in which the disposition of the black is regulated by the larval areas and forms the pattern, these characters have as a rule the meaning assumed for them in *Plethodon,* some species of which have remains of a black-and-red or yellow coloration.

Plethodon yonahlossee is the only eastern form which retains all the above primitive characters. *Glutinosus* lacks the dorsal pattern and indeed all trace of red or yellow. It also has fewer vomerine teeth. *P. jordani* is not well known, but it comes next to *yonahlossee* in regard to vomerine teeth and retains a trace of yellow coloration in the cheek patches.

As noted above *æneus* appears isolated to a remarkable extent.

P. shermani, metcalfi, and *wehrlei* constitute a group characterized by medium size, and few teeth. *P. wehrlei* is most specialized with 17 costal grooves and no color. *P. shermani* is the most primitive with red legs and 14 costal grooves.

P. dorsalis and *erythronotus* are the smallest forms. They have few vomerine teeth. However, they possess very definite dorsal coloration. There is a melanistic phase of each which almost entirely obscures the red in life, while in preservative there is no trace of it left.

P. dorsalis has 16 costal grooves and the dorsal pattern is a zigzag band. A zigzag band is intermediate between spots and the straight-edged band of *erythronotus*. Thus *dorsalis* would appear to be the least specialized. It occurs in Kentucky, Ohio, and Indiana.

Of these nine forms, *erythronotus* and *glutinosus* are by far the widest ranging. *P. metcalfi* occurs all over the North Carolina mountains at high altitudes. *P. æneus* ranges in the Cumberland Mountains from the Alabama line to Virginia and West Virginia. The others are known only from the vicinity of the type localities: *P. jordani* from the Great Smokies; *P. shermani* from the Wayah Bald Mountain in southwest North Carolina; *P. wehrlei* from Indiana Co., Pennsylvania; and *P. yonahlossee* from Grandfather Mountain.

The measurements of the type series follow; I include one of the National Museum specimens.

Length	Head	Body	Tail			
165	19.2	60.8	85	U. S. N. M.		
140	19	58	63	Am. Mus. Type		
142	17	55	72	"		
142	16	54	72	"		
133	16	52	65	"		
117	16	48	53	"		
126	16	50	60	"		
103	15	50	38	"		
95	14	46	35	"		
111	13.5	41.5	56	"		
103	13	40	50	"		
105	13.5	43.5	58	"		
116	13.5	41.5	61	"		
97	11	38	48	"		
92	13	36	43	"		
81	12	38	31	"		
83	10	33	40	"		
81	10	30	41	"		
62	8	25	29	"	Dorsal	spots.
42	9	26	5	"	"	"
61	8	23	30	"	"	"
58	7.5	23.5	27	"	"	"
57	8	23	26	"	"	"
57	7.5	22.5	27	"	"	"

Specimens 23, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
542	4633–44	Linville	4200	Aug. 16
545	4666–7	"	"	" "
559	4711–4	"	"	" 17
575	4853–6	"	"	" 19

3. **Plethodon glutinosus** (*Green*).

Plate LVII, Fig. 5.

The relationships of this form to *P. yonahlossee* and to *P. metcalfi* have been discussed in the accounts of those forms. We found *glutinosus* common, wherever there were *Plethodons* at all, up to 4000 ft.

The dentition of our specimens is fairly constant. The vomerine series consists of about 11 rather large teeth in a slightly curved line, extending beyond the choanæ, separated from each other by $\frac{1}{3}$ the length of the series and from the parasphenoid patches by $\frac{1}{2}$ the length of the series. The parasphenoid patches are separated by a narrow groove.

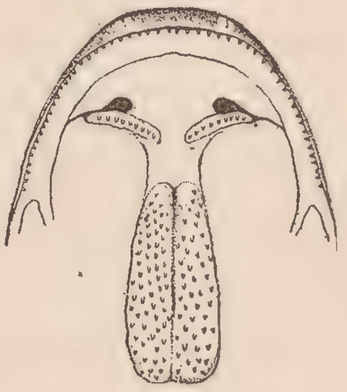


Fig. 2. *Plethodon glutinosus*, No. 4789. Roof of mouth to show dentition. $\frac{2}{1}$.

Where these salamanders were common, their burrows were found to be very extensive, sometimes opening onto the side of a road cutting. I have seen *P. glutinosus* lying in the mouth of its burrow just as a toad does.

Measurements of a series of *P. glutinosus*, including the largest and smallest:

Length	Head	Body	Tail
129	14	60	55
128	16	60	52
155	15	59	81
148	15	58	75
159	16.5	57.5	85
142	15	57	70
146	16	53	77
142	16	53	73
135	14	51	70
108	12	43	53
49	7	21	21
41	6	19	15
45	6.5	18.5	20
42.5	6	16.5	20

Specimens 80, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2503	4097	Camp	2200	July 3
2504	4098	"	"	" "
2513	4099–130	"	"	" "
2515	4104	"	"	" "
2604	4114	"	"	" 6
2609–11	4115–7	"	"	" "
2619	4118	"	"	" 8
2620	4119	"	"	" 9
2621	4120	"	"	" 10
2633	4121	Low grounds near Camp	2100	" 11
2637	4122	Camp	2200	" "
2638	4123	"	"	" "
2639	4124	"	"	" "
2647	4125	Across river from Camp	"	" 13
2657	4127	Road to See-off	2700	" "
2671	4129	See-off	3000	" "
2669	4165	"	"	" "
2667	4128	"	"	" "
2687	4341	Elk Lodge Mt.	2700	" 19
2744	4434–6	Pink Beds	3500–4000	July 31
2751	4452	Camp	2200	" 30
2752	4453	Pink Beds	3500–4000	" 31
2770	4471–5	Camp	2200	Aug. 5
546	4668–9	Linville	4200	" 16
543	4645–63	"	"	" "
565	4789–98	"	"	" 17
577	4864–9	"	"	" 19

4. **Plethodon metcalfi** *Brimley.*

Plate LVII, Fig. 4.

This is a very common and characteristic salamander of the higher mountains. We got it on See-off in company with *glutinosus* at about 3000 ft., at Pink Beds from 3500–5000 ft., with *glutinosus* as far as 4000 ft., and at Linville at 4000–4200 ft., in company with *erythronotus, glutinosus,* and *yonahlossee.*

Thus the ranges of *metcalfi* and *glutinosus* overlap to a considerable extent. The two forms, however, remain quite distinct, and I am inclined to think that there is little relationship. The only difference in habits observed was that *metcalfi* was more agile and less slimy than *glutinosus,* less slimy and less agile than the new form, and more agile and more slimy than *erythronotus.*

It differs from *glutinosus* in never having the white spots of that species. From the evanescence of these spots in preservative, from their appearance under a microscope, and from their disappearance at the least touch of caustic potash, Mrs. Harris H. Wilder, of the Smith College zoölogical department, has suggested to me that they are inclusions of carbon dioxide gas. At any rate they are underlain by the black pigment, and they thus differ greatly from that other white which is simply absence of pigment.

P. metcalfi differs from *glutinosus* in the much lighter belly. This holds good for most specimens, but some very small *glutinosus* have the belly very pale. The belly lacks the larger unpigmented dots of *glutinosus*. The pale color of the belly is caused by the weakening of the borders of the minute unpigmented dots which cover the whole surface of *glutinosus, shermani,* and *metcalfi.* It is noteworthy that this weakening is in operation on the dorsal surface as well but to a less degree. Still, *metcalfi* is noticeably paler than *glutinosus,* on every part of the body. "Gray ghost" is an appropriate epithet for this species. *P. metcalfi* is smaller than *glutinosus.* Brimley's largest specimen was 140 mm. long, but this must be a very unusual specimen as the range of our series of 160 specimens is 35–119 mm. Our series of 80 *glutinosus* range from 41–159 mm.

Its proportions are almost exactly similar to those given by Stejneger for the type of *P. shermani.* However, the long tail is not so different from the tail of *glutinosus* as in both species the tail may be as much as 53% of the total length. But the tail of *metcalfi* and of *shermani* is much slimmer. The costal grooves are exactly as described for *shermani; i. e.* 14 not counting one at axilla and one at groin, neither of which descends to lower surface. The appressed limbs fail to meet by two intercostal folds. The vomerine teeth are in two short, oblique, curved, series which extend a little farther than the outer border of the choanæ, each series consisting of 6–7 rather large teeth. The distance between the series posteriorly equals about $\frac{1}{3}$ the length of the series. The distance from the parasphenoid patches is greater than the length of the series. The paraspenoid patches are confluent or divided by a narrow groove. It is probable that this species is most nearly related to *P. shermani* Stejneger. *Shermani* differs in its red legs (the black being absent). The legs of *shermani* are also somewhat larger. The other proportions and the general size and color are the same. The parasphenoid patches are divided in the type of *shermani,* but as another specimen from the type locality has these teeth in one patch, and as two *glutinosus* of the same size from Blantyre, have one a single patch and the other two quite dis-

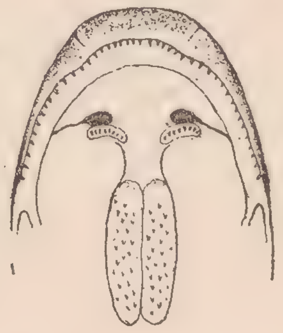


Fig. 3. *Plethodon metcalfi,* No. 4388. Roof of mouth to show dentition. $\frac{2}{1}$.

tinct patches, very great importance cannot be attached to this character. On the whole the vomerine series seem much more constant, and in regard to these teeth *metcalfi* and *shermani* resemble each other in having the shortest series with the fewest teeth of any Eastern *Plethodon*, *erythronotus* perhaps excepted.

Length	Head	Body	Tail	
104	11.5	36.5	56	Type of *shermani*
98	13	48	37	*metcalfi*
119	13	47	59	"
116	13	46	57	"
115	12	43	60	"
108	12	42	53	"
97	11	36	50	"
96	10	36	50	"
80	11	35	34	"
47	6	20	21	"
48	6	18.5	23	"
42	6	16	20	"
40	6	16	18	"
35	5.5	14.5	15	"

Specimens 160, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2666	4163	See-off	3000	July 13
2668	4164	"	"	" "
2670	4166	"	"	" "
2738	4428–33	Pink Beds	3500–5000	July 31–Aug. 1
541	4601–32	Linville	4200	Aug. 16
547	4670–1	"	"	" "
566	4799–847	"	"	" 17
567	4848–50	"	"	" "
578	4880–942	"	"	" 19
579	5001–2	"	"	" "

5. **Plethodon erythronotus** (*Green*).

Very common near Linville. Out of 48 specimens collected there, only 2 had black backs. There is no approach to *dorsalis* in our specimens as all have 19 costal grooves and straight-edged bands of red.

Miss Thompson had one at Pink Beds. We did not find it there or around Brevard.

48 specimens as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
536	4536–44	Linville	4200	Aug. 16
551	4677	"	"	" "
560	4715–20	"	"	" 17
581	5011–41	"	"	" 19
582	5054	"	"	" "

6. **Desmognathus quadramaculata** (*Holbrook*).

Plate LVIII, Figs. 1 and 2; Plate LIX, Fig. 1.

Very common in streams. We never found one away from water. They seemed to us practically aquatic, as we often came upon them wandering around in the water. They are extremely active and hard to catch or hold. It is a surprising sight to see one of these big black salamanders run down a sloping bank into the water, for all the world like a water snake. On several occasions captured specimens attempted biting.

Around Brevard they came down to 2100 feet in large streams, to which they seemed confined. At Linville they occupied both large and small streams. The explanation seems to be that *D. monticola* inhabits small streams which rise at or below 4000 feet, while *D. quadramaculata* follows down streams which rise above that line. This is not an absolute rule, but it holds in most cases and a stream in which *quadramaculata* is common usually contains few *monticola* and vice versa.

Larvæ were caught ranging in size from 37–63 mm. The size of transformed specimens ranges from 49–164 mm. It is noteworthy that both the smallest adults and the smallest larvæ come from Linville where they seem to transform at a smaller size. However the species reaches as great a size at Linville as at Brevard.

The larvæ are easily distinguishable from all others taken by their stout legs and glistening white gills (with the possible exception of No. 4519, which I identify as *Leurognathus marmorata*). The females had developing eggs in their ovaries.

Specimens 84, as follows: 12 larvæ and 72 adults.

Field No.	Am. Mus. No.	Locality	Alt.	Date
2518	4105	Camp	2200	July 3
2562–9	4106–13	Rt. Fork, Cathey Creek	3000	“ 4
2648	4126	Road to See-off	2600	“ 13
2663	4192	See-off	3000	“ “
2699	4352	Rt. Fork, Cathey Creek	2800	“ 24
2712	4362	Str. opp. Pisgah Forest	2400	“ 25
2713–4	4363–4	“ “ “ “	“	“ 24
2734	4388–90	Pigeon Gap, Pink Beds	3200–3500	July 31–Aug. 1
2750	4442–51	Rt. Fork, Cathey Creek	2400–3000	July 24
2766	4464	Williams Creek	2100–2400	Aug. 4
2780	4477	Str. opp. Pisgah Forest	2200–2400	July 25
“	4479–86	“ “ “ “	“	“ “
“	4488–91	“ “ “ “	“	“ “
509	4511–3	Str. opp. Davidson R.	2500	Aug. 7

Field No.	Am. Mus. No.	Localitity	Alt.	Date
518	4522–3	Pineola	3800	Aug. 14
525	4526–30	Rt. Fork Lost Cove Creek	3800	" 14
550	4535	Linville	4200	" 16
537	4545–52	"	"	" "
563–4	4768–88	"	"	" 17
585	5042	Pineola (Mortimer)	2500	" 21

7. **Desmognathus monticola** *Dunn.*

Plate LVIII, Figs. 3–5.

Generally abundant. This species resembles *D. fusca* very closely in its habitat relations. It is not nearly so aquatic as *quadramaculata* and is found only around small streams. The rocky edges of the mountain brooks and springs along the sides of roads simply teem with this species. We sat under a tree on the side of a road during a rain and four or five crossed the road in half an hour. While we were climbing Grandmother Mountain early one morning, one ran across our path with a partly eaten earthworm in its mouth. It wanders more openly than do the other species of *Desmognathus.* One sees *quadramaculata* frequently at large but only in streams. The vertical range was from 2200 to 4000 feet.

No specimens of *monticola* are in any way an approach to *fusca,* to *carolinensis,* or *quadramaculata.* It seems an entirely distinct form.

No larvæ were seen. No eggs were found, although the females had developing eggs in their ovaries. This would indicate a somewhat different spawning time from *fusca,* but a similar duration of larval life.

Specimens ranged in size from 30 to 135 mm.

The oldest and largest males lack the vomerine teeth. However they do not lose these teeth at sexual maturity, as do the males of all the other species of the genus except *quadramaculata.*

One hundred specimens, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2519	4060	Camp	2300	July 3
2523–49	4061–87	Road along Kings Creek	2500–3000	" 4
2514	4130	Camp	2200	" 3
2641	4176	"	"	" 11
2650–6	4180–6	Road to See-off	2600	" 13
2658–9	4187–8	Creek north from See-off	3000	" "
2661	4190	" " " "	"	" "
2664–5	4193–4	" " " "	"	" "
2675–79	4195–9	See-off	3100	" "
2684–5	4338–9	Elk Lodge Mt.	2500–2700	" 19

Field No.	Am. Mus. No.	Locality	Alt.	Date
2709	4359	Str. opp. Pisgah Forest	2400	July 24
2728–9	4369–70	Elk Lodge Mt.	2400–2700	" 19
2730	4371–8	" " "	"	" "
2736	4392–4402	Pigeon Gap, Pink Beds	3200–4500	July 31–Aug. 1
2737	4419	" " " "	"	" " " "
2748	4440	Brevard (Elk Lodge)	2300	July 29
2766	4463	Williams Creek	2100–2400	Aug. 4
2766	4465–7	" "	"	" "
2780	4478	Str. opp. Pisgah Forest	2200–2440	July 25
"	4487	" " " "	"	" "
503	4505	Williams Creek	2200	Aug. 7
508	4510	Str. opp. Davidson River	2600	" 5
531	4533	Grandmother Mt.	4000	" 15
538	4553–9	Linville	4000	" 16
549	4676	"	"	" "
580	5003–10	"	"	" 19
586	5043	Pineola (Mortimer)	2500	" 21
593	5047	No data		

8. **Desmognathus fusca** (*Raf.*).

Near Midway Mills, Nelson Co., Va., we got specimens of this well-known form at 500 ft. elevation.

Specimens 7, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
593	5044–6 5048	Wingina, near Midway Mills	500	Aug. 29
594	5049	" " " "	"	" "
595	5050–1	" " " "	"	" "

9. **Desmognathus ochrophæa carolinensis** *Dunn.*

Plate LVIII, Figs. 6–9.

Not uncommon in the low grounds around Brevard. Common at Pink Beds and at Linville.

At Brevard they are seldom found away from damp places such as *monticola* frequents, rarely occurring together, however, as *monticola* does not come down to the low grounds or below 2200 feet. Higher up in the mountains, at Pink Beds and at Linville, *carolinensis* is almost wholly terrestrial. But occasional exceptions are found. Thus at Linville they were found everywhere from under a rock in water to under bark of a tree five feet above the ground, but by far the greater part were under logs on the ground. They must be great wanderers, but are very secretive and are never seen abroad.

This is a variable and puzzling form. Some specimens are exactly like northern *D. ochrophœa* in color; others are spotted, and in these the dorsal surface may be red or yellow. Most of the larger specimens are uniform purplish. Northern *ochrophœa* are always striped.

There is an unmistakable trend toward *fusca* in the French Broad Valley specimens. This is doubtless correlated with the difference in habitat mentioned above. At Asheville, in the French Broad Valley, *fusca* occurs. It is quite possible that intergradation takes place, but until it is proved I think it best to let *carolinensis* stand as a subspecies of *ochrophœa* because I believe *ochrophœa* to be derived from *carolinensis* rather than from *fusca*. At any rate, the form *carolinensis* is intermediate between the form *fusca* and the form *ochrophœa*.

Brevard specimens of *carolinensis* are much smaller than *fusca;* their coloration is like that of the mountain specimens in frequently having the immaculate dorsal stripe, which *fusca* never has; the tails of about half the specimens are cylindrical, half have the tail somewhat flattened, and a few of the smallest have a dorsal keel. Typical *fusca* has a decidedly flattened tail with an evident dorsal keel. Asheville specimens are like ordinary *fusca* but seem slightly smaller.

Females with eggs were found twice; one 69 mm. long, at 2300 feet at Brevard, July 21: and one 55 mm. long, at 3500 feet, at Pink Beds, July 31. Each had 10–15 eggs, a very small batch compared with the 30 eggs produced by average *fusca*. The Brevard eggs were more advanced than those at Pink Beds, which were in the first stages of division. The former eggs contained large embryos on which a pattern of spots could be made out. Unfortunately I tried to keep them to hatch and a large *D. monticola* was probably responsible for their entire disappearanace. Both females were found in rotten logs on the banks of a stream.

No larvæ were found and it is to be doubted whether there is any definite aquatic larval stage.

The range in size was from 25–96 mm.

We caught 213 specimens, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2550–4	4088–92	King's Creek	2500–3000	July 4
2556–8	4093–5	" "	"	" "
2502	4096	Camp	2200	July 3
2516	4131	"	"	" "
2521	4132	"	"	" "
2583–96	4133–46	"	"	" "

Field No.	Am. Mus. No.	Locality	Alt.	Date
2607	4167	Camp	2200	July 6
2627	4169	“	“	“ 10
2640	4175	“	“	“ 11
2642	4177	“	“	“ 12
2646	4178	East side River near Wilson Br.	2100	“ 13
2649	4179	Road to See-off	2600	“ “
2662	4191	Creek north of See-off	3000	“ “
2686	4340	Elk Lodge	2700	“ 19
2688	4342	Camp	2200	“ 20
2697	4350	East side R. (with eggs)	2300	“ 21
2698	4351	Rt. Fork Cathey Creek	2400	“ 24
2710–1	4360–1	Str. opp. Pisgah Forest	2400	“ “
2716	4366	“ “ “ “	“	“ “
2737	4403–18	Pigeon Gap, Pink Beds	3300–4500	July 31–
“	4420–7	“ “ “ “	“	Aug. 1
2745	4437	“ “ “ “ (with eggs)	3500	July
2765	4462	Williams Creek	2300	Aug. 4
2766	4468–9	“ “	“	“ “
2754	4455–7	Pigeon Gap, Pink Beds	3300–4500	July 31–Aug. 1
2780	4492–3	Str. opp. Pisgah Forest	2200–2400	July 25
2782	4494	Elk Lodge	2500	“ 19
2786	4497	Camp	2200	“ 28
2796	4500	Between Pisgah Forest and Elk Lodge	2200	“ 29
2800	4503	Brevard (Elk Lodge)	2300	“ “
507	4509	Opp. Davidsons River	2600	Aug. 7
523	4525	Pineola	4100	“ 14
539	4573–98	Linville	4200	“ 16
548	4672–5	“	“	“ “
561	4721–64	“	“	“ 17
562	4765–7	“	“	“ “
579	4943–5000	“	“	“ 19

10. **Leurognathus marmorata** *Moore.*

Plate LIX, Fig. 3.

I refer one larva caught in Grandmother Creek just below the lake to this species. Moore's statement that *L. marmorata* is more aquatic than *Desmognathus quadramaculata,* the absence of adults or larvæ in small streams near Linville which we searched thoroughly, and this larva from Grandmother Creek, all go to show that this species inhabits large streams. On several occasions we noticed salamanders in the Linville River. All those we could catch however, turned out to be *Desmognathus quadramaculata.* The larva shows Desmognathine affinities in its stout hind legs, glistening white gills, and dorsal fin only on the tail. No larvæ known have all these characters save those of *Desmognathus*. It is much too large (63 mm.) for *monticola*, which transforms at 30 mm., or *carolinensis* which is even smaller. In size and general appearance it agrees with larvæ of *D. quadramaculata* collected at Brevard and Linville. It differs however, in the much longer tail, the shorter and slimmer head, and the slimmer body.

Comparison of proportions of several larvæ:

Length	Head	Body	Tail	
63	8	24	31	*Leurognathus marmorata*
48	6	22	20	*Desmognathus quadramaculata*
52	8	23	21	" "
55	8	24	21	" "
59	9	25	25	" "
63	10	26	27	" "
63	10	31	22	" "

The eyes are larger and farther apart. The head of a *quadramaculata* larva bears more resemblance to that of a pig, while this unique larva rather resembles a squid with its great staring eyes.

The color is much darker, although the pattern seems about the same. There is no light line from the eye to the angle of the jaw, which line is quite evident in both larval and adult *quadramaculata*. Finally the under side of the throat is pigmented, reminding one of the larva of *Gyrinophilus danielsi*. The throat of *quadramaculata* larvæ is unpigmented.

While I think there can be no doubt that this larva is distinct from *D. quadramaculata*, I hesitated for some time before referring it to *Leurognathus marmorata*. *L. marmorata* differs very slightly in proportions from *D. quadramaculata*, and the color is usually lighter especially in young specimens. Thus the larva on hand would seem to differ from *L. marmorata* more than *D. quadramaculata* does. However there are only two possibilities; either this is the larva of *L. marmorata*, an animal known only from 5 specimens (4 of which are from the Atlantic drainage on the slopes of Grandfather Mountain), or there exist in the Atlantic drainage on the slopes of Grandfather Mountain two rather aquatic salamanders, much resembling *D. quadramaculata*, and known only from four adults and one larva respectively.

Field No.	Am. Mus. No.	Locality	Alt.	Date
515	4519	Grandmother Creek, just below the lake, Pineola, N. C.	3800	Aug. 13

11. **Gyrinophilus danielsi** (*Blatchley*).

Plate LIX, Fig. 4.

The larvæ of this species were not uncommon near Brevard, but we saw no adults save one, which Miss Thompson caught near Pink Beds.

They may be easily told from the larvæ of *Spelerpes ruber schencki* by their longer heads and slimmer bodies, by the pigmentation of the sides of the throat and middle of the chin, and by their not having the middle row of unpigmented larval areas so numerous or so close together. They reach a much larger size than do the larvæ of *S. r. schencki.* The characters given above will also serve to distinguish the larvæ of *G. porphyriticus* from those of *S. ruber.*

Examination of the skull of an adult in the National Museum has disclosed separate pre-maxillaries, and led to the reference of this species to the genus *Gyrinophilus,* confirming a suspicion which I had previously entertained on account of the coloration and general form of both adult and larvæ.

This species differs from *G. porphyriticus,* which it seems to replace in the Alleghenies south of Virginia and West Virginia, in having a spotted instead of a clouded coloration, and in having two distinct lines, a black and a white, from the eye to the nostril, whereas *porphyriticus* has only the light line distinct.

All the specimens were taken in the water of small streams, usually hiding under a half-submerged log or stone.

They range in size from 56 to 92 mm.

Specimens 7, all larvæ, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2571	4147	Camp	2200	July 3
2570–1	4149–50	Rt. Fork Cathey Creek	3000	" 4
2715	4365	Str. opp. Pisgah Forest	2400	" 24
2735	4391	Pigeon Gap, Pink Beds	3500	Aug. 1
2746	4438	" " " "	"	" "
2773	4476	Camp	2300	" 5

12. **Spelerpes ruber schencki** *Brimley.*

Plate LIX, Fig. 5; Plate LX, Fig. 1.

We got 8 adults, 3 transforming young and 17 larvæ of red *Spelerpes.* All but one were taken near Brevard and are evidently of the form *S. r. schencki* Brimley.

Compared with *ruber* from Pennsylvania they have longer heads, shorter tails, and blacker chins. The dorsal coloration is somewhat clearer in that the edges of the spots do not run together as in specimens of *ruber* from Haverford, Pa. They are about the same size as Haverford *ruber* but seem to transform at a smaller size as the larvæ range from 28–59 mm., the transforming young from 57–72 mm., and the adults from 95–123 mm. Haverford larvæ reach a length of 110 mm., adults there ranging from 80–134 mm. I can detect no difference in the dentition between Brevard and Haverford specimens.

It will be noted that *schencki* agrees much more closely with Haverford *ruber* than with the Raleigh, N. C., form with which Brimley compared his types. This is explained by the fact that red *Spelerpes* from Raleigh agree in every particular with the type of *Spelerpes montanus* (Baird) in the National Museum, and should be referred to that species. *Montanus* has a dark ground color, very few spots, a very short head, and a very long tail. The series of vomerine teeth are closely approximated in front.

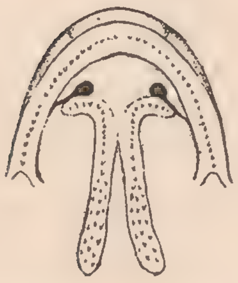


Fig. 4. *Spelerpes ruber schencki*, No. 4458. Roof of mouth to show dentition. $\frac{2}{1}$.

Series of red salamanders have been examined from Raleigh and Brevard, N. C., Alexandria, Va., Haverford, Pa., and Deer Island, Maine. Specimens from the last four localities agree in dentition, differing from Raleigh specimens in having the two vomerine series distinctly separated; while they also agree in general coloration, differing from Raleigh specimens in having many spots and no ground color.

Those from the last three localities agree with one another and differ from the Brevard specimens in lacking the black chin and in having the spots of adults somewhat diffuse and running together. Thus, adults of Haverford *ruber* approach in color adults of Raleigh *montanus*, but by a different process. In *montanus* the ground color grows dark and the spots have little to do with the general effect, being few and far between; while in *ruber* the ground color is practically lacking and the spots nearly cover the dorsal surface.

In proportions, Brevard specimens have the longest heads and the shortest tails. Maine and Raleigh specimens have the shortest heads and the longest tails. Specimens from Alexandria and Haverford are intermediate, those from Virginia being closest to those from Brevard. Thus there is a gradual change in the proportions of *Spelerpes ruber* from the North Carolina Mountains to the Maine Coast.

At Linville one specimen was taken. This lacked the black chin of *schencki*, but agreed with it in other respects. It is a rather young one and thus the dorsal spots are noncommittal. However as Brimley states that specimens from Burnsville and Cane River also lack the black chin, it is probable that *schencki* as such is restricted to the mountains south of Asheville.

The habits of this form were quite similar to those of *ruber* as I have observed them at Haverford. Most of the adults and all of the larvæ and transforming young were taken in swampy springs. The Linville specimen and one adult from Brevard were found under logs some distance from the water. I have occasionally found *ruber* away from water at Haverford.

A noticeable difference was that *schencki* specimens were much less active and more easily caught than typical *ruber*. They seemed to be somewhat nocturnal, as several were caught wandering in the camp spring at night. This also agrees with observations made on *ruber* at Haverford.

The differences between larvæ of *S. r. schencki* and larvæ of *Gyrinophilus danielsi* have been dwelt on in the discussion of the latter. Save for the smaller average size there seems to be no difference between larvæ of *schencki* and larvæ of *ruber* from Alexandria and Haverford.

Specimens 27, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2522	4148	Camp spring	2200	July 4
2597	4151	“ “	2200	“ 6
2598–600	4152–4	“ “	“	“ “
2617	4161	“ “	“	“ “
2628	4170	Low ground spring near Brevard	2100	July 10
2635	4162	Side of road near Camp	2200	“ 11
2662	4189	See-off	3000	“ 13
2689	4343	Camp spring	2200	“ 20
2696	4349	Southeast of Brevard	2200	“ “
2702	4355	Spring near Yonway(east side of river)	2700	“ 21
2705	4358	Spring near Yonway (east side of river)	“	“ “
2733	4386–7	Pigeon Gap, Pink Beds	500	Aug. 1
2746	4439	“ “ “ “	“	“ “
2749	4441	Camp spring	2200	July 29
2762	4458	Williams Creek	2100	Aug. 4
2764	4460–1	“ “	“	“ “
2768	4470	Low ground spring near Brevard	2100	“ 5
2784–5	4495–6	Camp spring	2200	July 28
2797	4501	Near Pisgah Forest	2200	“ 29
504	4506–8	Williams Creek	2100	Aug. 7
510	4514	Camp spring	2200	“ “

13. **Spelerpes ruber ruber** (*Daudin*).

While I have not seen Daudin's original description of *Salamandra rubra,* there is no doubt that the form occurring at Philadelphia is the one which has borne the name for many years. As noted above, the specimen from Linville agrees more closely with the northern race of *Spelerpes ruber,* to which I therefore refer it.

One specimen, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
574	4852	Linville	4100	Aug. 19

14. **Spelerpes guttolineatus** (*Holbrook*).

Plate LIX, Fig. 6 and 7; Plate LX, Fig. 2.

We caught this beautiful salamander only at Brevard below 2500 ft. It seemed to be nocturnal and a good deal of a wanderer. On our night trips after frogs we saw this species several times. They could be found after the flood under debris at high water mark, where they had been driven from the low ground ditches which formed their natural habitat. They were more agile and difficult to catch than even *Desmognathus quadramaculata.* "Guttos," "quads," and the big new Linville plethodons we called "Yonahlossees" (sp. nov. *Plethodon yonahlossee*), always gave us an exciting chase before we got them in the bucket or gave them up for lost.

While probably most nearly related to *S. longicaudus* (their ranges are adjoining and do not overlap) as will be shown in the discussion of larvæ, they differ in the greater agility, the larger size, and the much greater amount of black pigment. The markings of the one are easily derivable from those of the other, as Cope showed. The vomerine teeth of this species are in two long series which practically touch at the posterior end. In one specimen they parallel each other for $\frac{1}{4}$ of their length, approaching the parasphenoid series to the same distance.

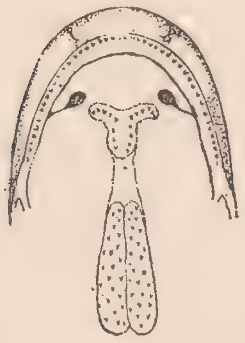


Fig. 5 *Spelerpes guttolineatus,* No. 4157. Roof of mouth to show dentition. $\frac{2}{1}$.

We got quite a series of larvæ, and as the larva of this species has not to my knowledge been described before (McAtee in the 'Life-history of *Spelerpes maculicaudus*' mentions large larvæ of *S. guttolineatus,* but by the description of these it is probable that they were specimens in the National Museum so labeled, which, while resembling *guttolineatus* in color to a remarkable degree, differ widely from it in structure, and are in fact larvæ of some species of *Ambystoma*; I refer to U. S. N. M. No. 3733, from New Madrid Co., Missouri), I may be pardoned for entering into a discussion of the stages in the development of its coloration, and a comparison with other *Spelerpes* larvæ. The larvæ ranged in length from 19–38 mm. A specimen in some stage of transformation 45 mm. long was also taken.

In the small 19 mm. larva the three series of unpigmented larval areas are quite evident. There are 10 in the upper row, 11 in the middle, and about 25 in the lower. The numbers of areas in a row are more or less variable in all the species I have examined, so that their condition or fate is more characteristic than their number. The areas of the lower row are nearly confluent. Pigment is present in a band ventral to this third row.

In *bislineatus* larvæ of the same size the third row is not apparent. In larger larvæ of *bislineatus* it appears as a very indistinct row ventral to most of the pigment. The third row in larvæ of *longicaudus* is quite indistinct (only large larvæ have been seen), but when evident appears to be confluent as in *guttolineatus*, the difference being chiefly in the amount of pigment ventral to it, which is much greater in *guttolineatus*.

In later stages of *guttolineatus* the third row is confluent and forms a distinct light line between the bases of the legs. The pigment ventral to it remains a stripe until metamorphosis when it spreads over the belly. The middle row is the least distinct of the three in *guttolineatus*. It is always composed of small areas, and is seen most plainly in transforming specimens or young adults as a row of light spots on the lateral dark band. Its condition in *bislineatus* is quite similar but it does not appear until later. It is very indistinct in *longicaudus*, and is scarcely visible after metamorphosis, owing to the breaking up of the lateral dark band into a row of spots. The dorsal areas become confluent at a very early stage in both *guttolineatus* and *longicaudus*. They are not entirely confluent in *bislineatus* until metamorphosis. Furthermore in *guttolineatus* and *longicaudus* the pigment gathers as a band ventral to the dorsal row, while in *bislineatus* the pigment gathers between the areas of the dorsal row, forming an interrupted stripe. Thus the prominence of the third row distinguishes *guttolineatus* from either *longicaudus* or *bislineatus*, while the early confluence of the dorsal areas distinguishes the first two from the latter. The indistinctness of the middle row distinguishes *longicaudus* from large larvæ of *bislineatus*.

The three larvæ discussed above can easily be told from larvæ of either *schencki* or *danielsi* by the lightness of the dorsal region as compared with the sides.

It will be apparent that the coloration of larval as well as adult *longicaudus* can be derived from that of *guttolineatus* by the simple subtraction of black pigment. *Longicaudus* apparently replaces *guttolineatus* in the Appalachian Valley and other limestone regions.

In regard to the frequent statement of the close relationship between *longicaudus* and *maculicaudus*, it should be noted that they remain distinct while occurring together throughout a great part of their range. The spotting of adult *maculicaudus* agrees more closely with that of *ruber* as Cope stated. The ground color of both is red and not yellow. So far as I know *ruber* and *maculicaudus* do not occur together. It may be pertinent in this connection to refer to Blatchley's specimen from eastern Tennessee, which according to his description, could be referred to either *ruber* or *maculicaudus* with equal propriety.

While the relationships of the species of *Spelerpes* are quite uncertain as yet, it seems to me that the above suggestion has some probability to recommend it and should at least be investigated more thoroughly.

Specimens 20, 8 adults, 1 transforming, 11 larvæ, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2612	4156	Low grounds near Brevard	2100	July 6
2613	4168	" " " "	"	" "
2622	4157	" " " "	"	" 10
2625–6	4158–9	Low ground spring near Brevard	"	" "
2629–32	4171–4	" " " " "	"	" "
2644	4160	River Road across from Brevard	"	" 13
2691–5	4344–8	Low ground spring near Brevard	"	" 20
2727	4368	Elk Lodge Mt.	2400	" 9
2763	4459	River Road across from Pisgah Forest	2100	" 25
2791	4498	Ditch in low grounds, Brevard	"	" 29
2798	4502	Under plank on hillside near Pisgah Forest	2200	" 29
2690	4710	Low ground spring near Brevard	2100	" 20

15. **Spelerpes bislineatus** (*Green*).

Plate LIX, Figs. 2 and 8; Plate LX, Figs. 3 and 4.

We found the larvæ of this species common in every small stream examined, and even in those as large as the Linville River. Adults were found rarely at Brevard. Only one adult and one transforming specimen were taken near there. At Linville both adults and larvæ were common, but adults were found only on land under logs in situations similar to those chosen by various *Plethodons* and by *Desmognathus o. carolinensis*, in fact often in company with these species.

There is great variability in color among the 13 adults collected at Linville. Some have a more sharply defined black band than any northern specimens seen; others are uniformly sprinkled with small spots and there is little or no trace of a band. These extremes grade into each other. They differ, however, from northern specimens in the very narrow head, and the usual absence of dark mottling ventral to the black stripe. This definiteness of marking in the striped specimens makes them very beautiful. On the tail the stripe is broken up into a row of spots.

It is with some doubt that I let this form stand as *bislineatus*. The existence of specimens without stripes and others which have the sides mottled indicates a variability in color which exceeds that of northern specimens in any direction. The fact that the stripe is broken up on the tail in all the specimens seems constant but is scarcely sufficient to serve as a basis for a new race.

This might also be merely a summer form, and the color differences the effect of a land residence. The head is narrow in all the specimens, and nearly all have marked labial cirri. Contrary to Cope's supposition this is not a larval character and is not homologous with the balancers of *Ambystoma* larvæ. Larvæ of *Spelerpes* do not have these cirri (or balancers either, so far as known) and the cirrus itself is a projection of the outside edge of the naso-labial groove, which groove is not present in larvæ, and is only found in adults of the Plethodontidæ. Cirri are individual characters of no systematic importance in *S. guttolineatus*. Their value in each form, however, must be determined for that form as far as possible and not through analogy.

The adults ranged from 36–75 mm. in length; larvæ from 17–37 mm.; a transforming specimen was 40 mm. long.

Specimens 38: 14 adults, 1 transforming, 23 larvæ, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2608	4155	Camp	2300	July 6
2681–3	4335–7	Spring near Pisgah Forest	2200	" 19
2700–1	4353–4	Cathey Creek	2800	" 24
2703–4	4356–7	Yonway Spring (across from Brevard)	2700	" 21
2753	4454	Pink Beds	3500–4000	Aug. 1
2792	4499	Low ground ditch near Brevard	2100	July 29
516	4520–1	Grandmother Creek	3800	Aug. 13
540	4599–600	Linville	4100	" 16
544	4664–5	"	"	" "
552	4678	"	"	" "
557	4699–701	"	"	" 17
558	4702–9	"	"	" "
576	4857–63	"	"	" 19
597	5052	Midway Mills, Va.	500	" 29
602	5053	" " "	"	" 30

Family SALAMANDRIDÆ.

16. **Notopthalmus viridescens** *Rafinesque.*

I cannot agree with Brimley's statement that "this species would appear to live in water only during the cooler portions of the year and to æstivate on land under dead logs and similar hiding places," for we found both land and water forms common in midsummer, and all of the land form were small immature specimens, ranging from 63–95 mm. in length; while the water form was larger: 92–120 mm. in length.

We got 50 specimens, as follows:

Field No.	Am. Mus. No.	Locality	Alt.	Date
2717	4367	Camp (Land form)	2200	July 14
2731	4379–85	Pink Beds (Water form)	3000–3200	" 31–Aug. 4
514	4515–18	Grandmother Lake (Water form)	3800	Aug. 13
520	4524	Near " " (Land form)	3800	" 14
526	4531–2	Lost Cove Creek (Water form)	2300	" "
532	4534	Grandmother Mt. (Land form)	3500	" 15
535	4560–72	Linville (Land form)	4100	" 16
554	4679–98	" " "	"	" 17
573	4851	" " "	"	" 19

Order SALIENTIA.

Family HYLIDÆ.

17. **Hyla pickeringi** (*Storer*).

We heard peepers nearly every night we were at Brevard; *i. e.*, from July 1–Aug. 5. Specimens caught were up in bushes in swampy places about five feet from the ground.

Two specimens, as follows:

4270	July 18	Brevard low grounds, alt. 2100 ft.
4307	Aug. 5	" " " " " "

18. **Hyla versicolor** *Le Conte.*

These tree-frogs also were heard all the time we were at Brevard. Specimens caught were on vegetation in swamps not more than a foot from the water.

Four specimens as follows:

4271–2	July 18	Brevard low grounds, alt. 2100 ft.
4313–4	Aug. 5	" " " " " "

19. **Acris gryllus** (*Le Conte*).

Heard nearly every night at Brevard. Some were caught in flooded pastures on grass just above water.

In the five specimens, the hind foot less tarsus is equal to or less than half of the length of head and body. The stripe on the femur is quite distinct. Thus these specimens do not fill the requirements of either *A. g. gryllus* or *A. g. crepitans,* but are intermediate.

5 specimens, as follows:

4308–12	Aug. 5	Brevard low grounds, alt. 2100 ft.

Family Bufonidæ.

20. **Bufo americanus** *Le Conte.*

Common at Brevard and as high as we went on the mountains. One caught on top of Green Knob in the Balsams at 5000 feet was identified in the field as this species, but it got out of the collecting bag and was lost. All that we caught were solitary, silent, and away from water.

In view of the difficulty of separating specimens of this form from the quite distinct *Bufo fowleri,* it may be as well to give the characters used in separating the North Carolina mountain series in order of their constancy in that series.

1. In *americanus* the post-ocular ridge sends a projection back at a right angle to meet the short, thick parotoid. In *fowleri* the long narrow parotoid is approximated to the post-ocular ridge itself, and there is no projection from the ridge to the parotoid.
2. The snout of *americanus* is much more flaring than the snout of *fowleri.* That is, the angle made by the top and sides of the head is greater in *americanus* than in *fowleri.* Thus in looking at the head from above, the muzzle can be seen around the eyes of *americanus* while the eyes of *fowleri* form part of the outline. This character is especially emphasized in old specimens of *americanus.*
3. The warts of *americanus* are larger and often arranged singly in a dorsal spot, while in *fowleri* the warts are smaller and usually arranged 3–7 in a spot.
4. The crests of *americanus* are much more pronounced than those of *fowleri.* This is more noticeable in comparing adults of the two species.
5. *Americanus* is larger than *fowleri.*

6. The belly of *americanus* is usually more spotted than the belly of *fowleri*.

Specimens 18, as follows:

Am. Mus. No.	Date		Locality	Alt.
4039	July	2	Camp	2200
4040	"	3	"	"
4043	"	5	"	"
4047	"	"	"	"
4050	"	"	"	"
4052–3	"	6	"	"
4055	"	"	"	"
4057	"	11	"	"
4274	Aug.	1	Pink Beds	4000
4275–6	July	21	Rich Mt.	3000
4278	Aug.	4	Glen Canyon	2500
4280	"	5	Camp	2200
4317	"	7	Davidson River	2200
4322–3	"	15	Grandmother Mt.	4000
4324	"	21	Pineola (Mortimer)	3000

21. **Bufo fowleri** *Putnam.*

Heard nearly every night at Brevard. There were great choruses of the males in the recently flooded low grounds. Now and then a solitary voice was raised from some small swamp or ditch. They did not range above 2700 feet.

Specimens 41, as follows:

Am. Mus No.	Date		Locality	Alt.
4041	July	3	Camp	2200
4042	"	4	Chestnut Knob	2700
4044–6	"	5	Camp	2200
4048–9	"	"	"	"
4051	"	"	"	"
4059	"	6	"	"
4273	"	18	Low grounds	2100
4279	Aug.	5	Camp	2200
4281–306	"	"	Low grounds	2100
4325	"	21	Pineola (Mortimer)	2700
4326–8	"	23–5	Midway, Va.	500

Family Ranidæ.

22. **Rana palustris** *Le Conte.*

Not uncommon at Brevard and at Linville. The note was not heard. Specimens 5, as follows:

Am. Mus. No.	Date	Locality	Alt.
4269	July 17	Brevard	2100
4277	" 21	"	"
4329	Aug. 13	Pineola	3000
4333	" 17	Linville	4200
4334	" 30	Midway, Va.	500

23. **Rana clamitans** *Daudin.*

Common at Brevard and at Linville. We heard the characteristic croak of this species at both places. None of the specimens has the yellow or whitish stripe from the nostril to the angle of the mouth, which Rhoads mentions in referring green frogs from Roan Mt. to *Rana clamitans melanota* (Rafinesque).

Specimens 4, as follows:

Am. Mus. No.	Date	Locality	Alt.
4054	July 6	Brevard	2100
4058	" 11	"	"
4331	Aug. 14	Lost Cove Creek	2000
4332	" 17	Linville	4200

24. **Rana catesbeiana** *Shaw.*

Common at Brevard. Its powerful bass note formed part of the chorus that serenaded us every night from the flooded low grounds.

Specimens 3, as follows:

Am. Mus. No.	Date	Locality	Alt.
4056	July 6	Brevard	2100
4315	" 29	"	2200
4330	Aug. 14	Lost Cove Creek	2300

Class REPTILIA.

Order **TESTUDINATA**.

Family Chelydridæ.

25. **Chelydra serpentina** (*Linn.*).

A shell was seen on the railway embankment at Hendersonville.

Family Emydidæ.

26. **Clemmys nuchalis**, new species.

Plate LXI.

Type: Am. Mus. No. 8430 (Field No. 569), collected on side of Yonahlossee Road, about 3 miles from Linville, North Carolina, August 17, 1916. Altitude, 4200 feet.

Diagnosis.— Very similar to *Clemmys muhlenbergi* (Schoepff), but with a longer nuchal plate, with the temporal blotch forked ventrally, and the female, at least with a flatter and broader shell.

The above differences are quite small, but as there is at present a considerable gap between the known distribution of the two forms, I think it best to emphasize their probable distinctness.

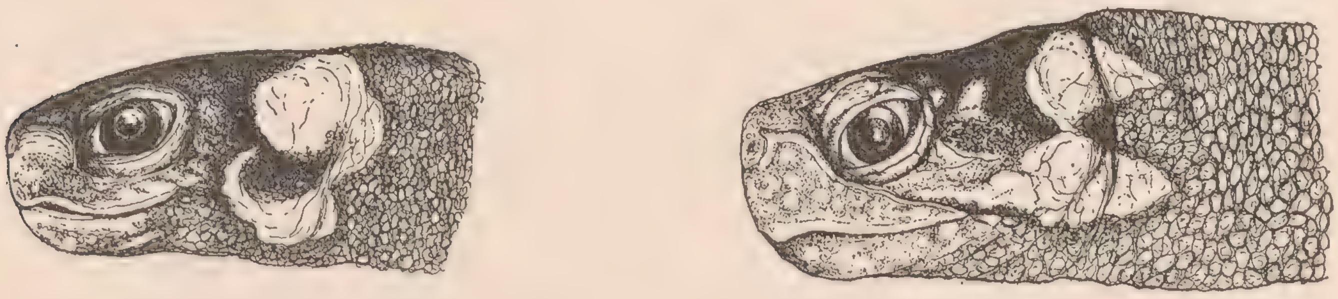


Fig. 6. Fig. 7.

Fig. 6. *Clemmys nuchalis* sp. nov., No. 8430. $\frac{1}{1}$.
Fig. 7. *Clemmys muhlenbergi.* $\frac{1}{1}$.

We collected four specimens of this form, three females from Brevard and a male from Linville. Of *C. muhlenbergi* 19 specimens, 13 males and 6 females, have been examined. These included the entire collection of the

American Museum of Natural History, the Philadelphia Academy of Natural Sciences, the National Museum, and Smith College. Thus probably most of the specimens of *C. muhlenbergi* in collections have been seen. They come from the following localities, to which I have added such records as I could find in literature.

Rhode Island: Newport.[1]
New York: Cayuga Lake Basin.[2]
New Jersey: Tenafly, Gloucester Co.; Hackensack; Palermo;* Trenton;* Medford;* Sayreville, Middlesex Co.; Audubon, Camden Co.*
Pennsylvania: West Bradford; Kenneth Square, Chester Co.; Tinicum;* Upper Darby, Delaware Co.

Murphy does not give it in his list of Long Island turtles in Copeia 33, nor does Fowler give it in his list from Cecil Co., Maryland. The Pennsylvania records from Chester County are the only ones from more than 100 feet elevation.

The range in length of carapace of *C. nuchalis* is in the females 79–93 mm., the male measuring 98 mm.

In *muhlenbergi* the same measurement gives for females 60–90 mm., and for males 84–98.

The sexes of either form may easily be told by the size and length of the tail which is much longer and thicker in males. The proportions of the shell of the two sexes are also different, the males being narrower and lower.

With age, females of *muhlenbergi* show a gradual decrease in proportional width. They are always proportionally higher than female *nuchalis*. When small, female *muhlenbergi* are as broad as female *nuchalis*, but the adults are narrower. Thus in females of *muhlenbergi* the width forms 72.22 to 81.6 per cent of the length. The same ratio in female *nuchalis* is 75.93 to 78.65 per cent. If however, we omit the smallest two *muhlenbergi*, leaving in our ratios only those of both forms over 79 mm., we have for *muhlenbergi* 72.22 to 75.08, and for *nuchalis*, 75.93 to 78.65. The height forms 44.11 to 46.66 per cent of the length in female *muhlenbergi*, and 41.23 to 43.85 per cent in female *nuchalis*. The height of female *muhlenbergi* does not seem to change with age as the extremes of the above ratios are represented by the two small ones. The ratio of height to width for female *muhlenbergi* is 55.55 to 63.33 per cent, for *nuchalis* 52.42 to 57.74 per cent, but omitting again the two small specimens of *muhlenbergi*, we have for that species 59.25 to 63.33 per cent.

---

* From literature.

[1] Babcock, H. L. Copeia, No. 42, April, 1917, p. 32.

[2] Reed, H. D., and Wright, A. H. Proc. Amer. Phil. Soc., Vol. 48, p. 409.

The length of the nuchal plate ranges from 6 mm. to 7.1 mm. in female *nuchalis,* and from 4 mm. to 6 mm. in female *muhlenbergi.* It is included in the length of carapace of female *muhlenbergi* from 13.6 to 16.4 times, and in that of female *nuchalis* from 12.7 to 13.2 times. No variation with age is apparent.

The one male agrees in bodily proportions with male *muhlenbergi,* as will be apparent from the following table:

Male *C. muhlenbergi*		Male *nuchalis*
Ratio of height to length	36.17–43.18	39.79
Ratio of width to length	63.15–75.51	72.44
Ratio of height to width	49.27–61.29	54.92

The nuchal plate of the one male is 8 mm. long. Nuchals of male *muhlenbergi* range from 4.9 to 7 mm. in length. They are contained in the carapace 12.8 to 19 times, while that of *nuchalis* is included 12.2 times.

In the four specimens of *nuchalis* the temporal blotch is almost cut in two by a deep narrow invasion of the ground color from the ventral side. This is rather different from the state of affairs in the *muhlenbergi* I have seen, in which the blotch is at most kidney-shaped and usually has no indication of a ventral notch.

Probably the specimens of "*Clemmys muhlenbergi*" which Yarrow recorded from Statesville, North Carolina, were this form. They are now lost. It may be worth while to add that Brevard is Mississippi drainage, whereas Linville and Statesville are Atlantic. The first is on the French Broad River, and the two latter on branches of the Catawba and Yadkin respectively.

Of the Brevard specimens, one was caught in a swamp, one in a shallow ditch, and one was given to us, having been caught wandering on a lawn. All three were found at about 2100 feet. The Linville specimen was caught away from the water, on the side of the Yonahlossee Road at 4200 feet.

Sex	Am. Mus. No.	Field No.	Length of Carapace	Width	Height	Nuchal
Female	8264	2643	89	70	36.7	7
"	8389	2720	79.2	62	33.7	6
"	8403	2767	93.5	71	41	7.1
Male	8430	569	98	71	39	8

27. **Terrapene carolina** (*Linn.*).

Very common around Brevard, but does not seem to range above 2500 feet.

Specimens 5, all from the neighborhood of Brevard, Nos. 8263, 8386, 8387, 8388, 8429.

Order SAURIA.

Family IGUANIDÆ.

28. **Sceloporus undulatus** (*Latreille*).

Common at Brevard. Not seen at Pink Beds or Pineola. It ranges up to 3000 feet on See-off, and to about the same altitude along Lost Cove Creek between Pineola and Mortimer. Young were seen first on August 14.

Specimens 6, as follows:

Am. Mus. No.	Locality	Date	Alt.	
8338	See-off	July 13	3000	
8390	Brevard	" 17	2300	
8391	Camp	" 20	2200	
8392	"	" 26	"	
8393	Brevard	" 29	2300	
8431	Lost Cove Creek	Aug. 14	2500	(young of the summer)

Family SCINCIDÆ.

29. **Plestiodon quinquelineatus** (*Linn.*).

Generally distributed around Brevard. All seen had light stripes and a blue tail except one specimen which Miss Thompson had at Pink Beds. Our altitude record for *P. quinquelineatus* is 3800 feet on Cedar Rock, where one came out from and went back under a rock which was sheltering at the same time a rattler and a copperhead. One specimen was taken near Mortimer, on Aug. 21, at 2000 feet, No. 8432.

Order OPHIDIA.

Family NATRICIDÆ.

30. **Natrix septemvittata** (*Say*).

We found these snakes common at Brevard, where they frequent small streams and lie on willow trees over the water. Near Pineola two were caught together under a railway tie in an abandoned logging road some distance from water. Both were females, and one of them gave birth to 11 young. Birth was somewhat premature in this case and the characters of the young could not be recorded. Not so with a female caught at Midway, Va., which gave birth, after arrival in New York, to eight well-developed young. In color the specimens are quite uniform and show no approach to the pattern of *grahami*. The strong sexual difference in the subcaudals is noteworthy. The young varied in length from 188 mm. to 200 mm. The tail of each of the three females was 50 mm. in length, those of the five males ranged from 55 mm. to 60 mm.

Specimens 13, as follows:

Am. Mus. No.	Sex	Locality
8395	Female	Brevard
8396	Male	"
8422	Female	Pineola
8421	"	"
8427	"	Midway
8428	(young of 8427)	

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows	Navel
8395	226	53	133	66	6–7/10	2–2	1–2	19–17	118
8396	297	81	135	81	7/10	"	"	"	118
8422	610	153	139	70	"	"	"	"	
8421	550	134	136	67	"	"	"	"	
8427	485	130	136	67	"	"	"	"	
8428	Female		137	68	"	"	"	"	120
"	"		137	72	"	"	"	"	119
"	"		143	74	"	"	"	"	124
"	Male		136	80	7/8–9	"	"	"	118
"	"		139	82	7/9–10	"	"	"	122
"	"		138	85	7/8–10	"	"	"	121
"	"		142	86	7/10	"	"	"	125
"	"		137	82	7/9–10	"	"	"	120

31. **Natrix sipedon** (*Linn.*).

Common at Brevard. (Miss Thompson had several at Pink Beds.) Captured four specimens, all from near Brevard. The oculars and temporals are the same throughout the series and are 1–3.

No.	Length	Tail	Ventrals	Caudals	Labials	Scale-rows	Bands on Neck
8336	419	54	134	?	8–9/10	21–23–17	14
8339	1042	245	136	63	8/10	23–17	10
8394	267	67	133	67	8/10	23–17	9
9397	940	223	137	72	8/10	23–25–17	7

32. **Thamnophis sirtalis** (*Linn.*).

Besides specimens taken at Pink Beds and Linville, we saw a dead one near Brevard at 2500 feet. The scale counts of the four garter-snakes are given. The coloration was that of typical *sirtalis*. I would like to call attention to the number of scale-rows, 21–17 in the Pink Beds specimen. Ruthven says that 598 out of 600 *sirtalis* examined had the count 19–17. The other two, from Florida, had 19–21–17. Hence this specimen has the highest scale count known in *sirtalis*.

Specimens 4, as follows:

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale rows
♀ 8374	545	130	145	63	7/8–9	1–3	1–3, 2	19–17
♀ 8400	611	122	146	63	7/9–10	1–4	1–2	21–17
♀ 8424	493	70	140	35	7/9	1–3	1–3, 2	19–17
♀ 8425	536	105	142	48	7/10–9	1–3	1–2	19–17

Nos. 8374, 8424, 8425 were from Linville, alt. 4200 feet; no. 8400 was from Pink Beds, 4000 feet.

33. **Storeria occipitomaculata** (*Storer*).

We got one at Pineola (alt. 3800 feet) (and Miss Thompson had one at Pink Beds).

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows
♀ 8416	210	55	116	56	6/7	2–2	1–2	15

34. **Coluber constrictor** (*Linn.*).

Two were seen but not caught near Brevard (alt. 2200 feet). A shed was seen near Linville at 4100 feet. A black snake was seen near Mortimer, at 2000 feet.

35. **Elaphe obsoleta** (*Say*).

We caught one on Green Knob Mountain, altitude 3500 feet.

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows
♀ 8399	1551	348	230	83	8/11–12	1–2	2–3	25–27–19

36. **Lampropeltis getulus** (*Linn.*).

A dead one found near Brevard, at 2300 feet, is our only record.

37. **Lampropeltis triangulum** (*Boie*).

We caught one coiled under a flat rock in an open field near Chestnut Knob Mountain, at 3500 feet, and one at Pineola at 3800 feet. (Miss Thompson had one at Pink Beds.)

In color the two specimens are examples of Cope's "*triangula*" and "*collaris*." The body spots of the "*collaris*" (No. 8258) reach the second row of scales anteriorly and posteriorly and the fourth row in the middle of the body. It seems futile to attempt to split the forms of milk snake with light postocular bands into subspecies, for no definable range can be given such forms. I think it best to regard these specimens (and others from the southern mountain) as simply rather variable representatives of the regular northern milk snake, extending southward in the mountains, as do so many other northern forms. In this I follow Dr. Stejneger.

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scales	Locality
♂ 8258	558	71	207	41	7/9	1–2	2–3	21–18	Brevard
♂ 8420	740	97	190	36	7/9	1–2	2–3	21–17	Pineola

38. **Diadophis punctatus** (*Linn.*).

Very common everywhere. We caught them from 1300 feet, near Collettsville, to 4200 ft., at Pink Beds and at Pineola. Usually found under bark of decayed logs. Four were caught in one such log on Cedar Rock. One or two others were roaming about.

The fifteen specimens vary chiefly in the color of the belly. In four there is a median series of spots, which in one specimen extends on to the anterior part of the tail. In two there are many scattered spots on the ventral surface and in one of these specimens the throat is spotted also. These six specimens are nos. 8417, 8426, 8408, 8410, 8411, 8419 in the order named. Three are large and three are small. Three are males and three are females. Hence this is not correlated with sex or age. The other nine specimens are immaculate beneath. The neck ring is interrupted dorsally in two of the smallest specimens.

The upper labials are usually eight but in other species seven. One of our specimens shows how this may take place, as it has seven on one side and eight on the other. The addition occurs anterior to the eye by the splitting of the third plate, or contrariwise the reduction is caused by the dropping out of the third plate in specimens with eight.

1 2 3 4 eye 5 6 7 8
1 2   4 “ 5 6 7 8

The lower labials may be 8 or 9. Here also the change occurs anterior to the eye, and is a matter of whether 5 or 6 plates touch the anterior genials.

1 2 3 4 5 6 | 7 8 9
1 2 3 4   6 | 7 8 9

It is odd that there should be so little difference between the caudal count of males and females. The scale rows are always 15, and the oculars are quite constantly 2–2.

No.	Length	Tail	Ventrals	Caudals	Labials	Temporals	Locality
♀ 8398	242	59	151	59	8/8	1–1	Pink Beds
♀ 8404	274	60	157	57	“	1–2	Brevard
♀ 8407	317	74	157	51	“	1–1	Cedar Rock
♂ 8408	330	80	161	57	“	1–1	“ “
♀ 8409	350	71	162	52	“	“	“ “
♂ 8410	283	70	151	57	8/9	“	“ “
♂ 8411	322	84	153	62	8/8	“	“ “
♂ 8412	381	90	151	59	8/9–8	“	Pineola
♂ 8413	382	87	158	56	8/8	“	“
♀ 8414	370	90	151	59	“	“	“
♂ 8415	372	92	151	58	“	“	“
♀ 8417	176	40	157	58	“	“	Linville
♀ 8418	194	50	163	60	8/9	“	“
♀ 8419	226	50	156	53	8–7/8	“	“
♀ 8426	324	90	165	50	8/8	“	Adako

39. **Carphophis amœnus** (*Say*).

Fairly common near Brevard. We always got it under slabs of bark on the ground in woods. Although most of our collecting at Linville was in exactly such localities, we did not find it there.

Labials 5/6, oculars 1–1, temporals 1–1, scale-rows 13.

No.	Length	Tail	Ventrals	Caudals	Locality	Altitude
♂ 8257	190	35	123	37	Chestnut Knob	3000
♂ 8261	226	43	123	37	See-off	3000
♂ 8262	242	46	116	37	“	“
♂ 8405	220	43	125	37	opp. Pisgah Forest	2500
♀ 8406	190	27	126	29	“ “ “	“

40. **Heterodon platirhinos** *Latreille.*

One was caught in the low grounds near Brevard. A dead one seen on the railroad track between Mortimer and Collettsville was very large (well over three feet) and entirely black save for the mid portions of the ventrals which were white. They were reported as very common in the French Broad low grounds, but the high water prevented our searching for them. and in all probability this high water caused great mortality among snakes, This species is interesting because the scale rows in dropping from 25–19, are not lost in the manner of the usual *Coronelline* or *Natricine* snake as Ruthven and J. C. Thompson have ascertained it, but in the manner given by Thompson for the snakes of the family *Boiginæ.*

The formula for *Heterodon* as derived from this specimen and three others (Raleigh, N. C., 1; Nelson Co., Va., 2) is 27–V, 25–IV, 23–XIII, 21–IV.

In a normal *Coronelline* or *Natricine* snake the rows dropped are adjacent ones, but in *Heterodon* and the back-fanged snakes a row on each side of the median is dropped at about the level of the gall-bladder.

No.	Length	Tail	Ventrals	Caudals	Labials	Oculars	Temporals	Scale-rows
♀ 8337	248	45	126	55	8/10–11	11–10	3–3	25–19

Family Crotalidæ.

41. **Agkistrodon contortrix** (*Linn.*).

The copperhead (here called "pilot") is well known but not common. We saw only one specimen at 3800 ft. on Cedar Rock. It went under a slab of rock which we were unable to move. On a collecting trip of similar character and duration in the mountains of Virginia, we should probably have taken more copperheads than any other kind of snake.

42. **Crotalus horridus** *Linn.*

Rich Mt. (2500 ft.), Green Knob Mt. (4000 ft.), and Cedar Rock Mt. (3800 ft.). The last specimen was not captured as it was under a great slab of rock. Poking around the edges caused it to retreat into a hollow underneath, and brought to light a skink and a copperhead which also escaped into the interior. In regard to the scale row count of the two specimens it is noteworthy that *Crotalus* shows the same type of row dropping evinced by *Heterodon,* and according to Thompson, by the *Boiginæ.*

The formula is: — 23–XI, 21–V, 19 cont.

No.	Length	Tail	Rattle	No. of Rattles	Ventrals	Caudals	Scale-rows
♀ 8401	1155	55	75	13	171	18	23–19
♀ 8402	985	50	50	11	170	18	23–19

Reptilian Eggs.— Two sets of eggs were found. One set consisted of 20 eggs, 32 by 22 mm., found on July 13 under a rock in a field east of the river near Brevard at 2100 feet. A shed of the blacksnake (*Coluber constrictor*) was under the same rock. Development had not advanced far enough to permit of the identification of the embryos beyond the fact that they were snakes. The second batch was of 3 eggs, 27 by 7 mm., found under a rock in a field near Chestnut Knob Mt., at about 3000 feet, July 3. In these the embryos were so undeveloped that it was impossible to tell whether they were lizards or snakes.

No. 8259, 3 eggs No. 8260, 19 eggs.

EXPLANATION OF PLATES LVII–LXI.

Drawn by Makoto Nishimura.

Plate LVII.

Figs. 1 and 2. *Plethodon yonahlossee* sp. nov., Am. Mus. No. 4634, in side and dorsal views, slightly under natural size.

Fig. 3. *Plethodon yonahlossee*, Am. Mus. No. 4666. $\frac{2}{1}$.

Fig. 4. *Plethodon metcalfi*, Am. Mus. No. 4838.

Fig. 5. *Plethodon glutinosus*, Am. Mus. No. 4789, slightly under natural size.

All from Linville, 4200 ft. elevation.

Plate LVII.

Figs. 1 and 2. *Desmognathus quadramaculata*, Am. Mus. Nos. 4768, Linville, 4200 ft., and 4364, stream opposite Pisgah Forest, 2400 ft. $\frac{1}{2}$.

Fig. 3. *Desmognathus monticola*, Am. Mus. No. 4375, Elk Lodge Mt., 2400–2700 ft. $\frac{1}{2}$.

Fig. 4. *Desmognathus monticola*, Am. Mus. No. 4555, Linville, 4000 ft. $\frac{2}{3}$.

Fig. 5. *Desmognathus monticola*, Am. Mus. No. 4060, Brevard, 2300 ft. $\frac{4}{3}$

Figs. 6, 7, 8, and 9. *Desmognathus ochrophæa carolinensis*, Am. Mus. Nos. 4950, 4948, 4955, and 4980, Linville, 4200 ft. $\frac{2}{3}$.

PLATE LIX.

Larvæ. All twice natural size.

Fig. 1. *Desmognathus quadramaculata*, Am. Mus. No. 4550, Linville, 4200 ft.

Fig. 2. *Spelerpes bislineatus*, Am. Mus. No. 4499, Brevard, 2100 ft.

Fig. 3. *Leurognathus marmorata*, Am. Mus. No. 4519, Pineola, 3800 ft.

Fig. 4. *Gyrinophilus danielsi*, Am. Mus. No. 4391, Pigeon Gap, Pink Beds, 3500 ft.

Fig. 5. *Spelerpes ruber schencki*, Am. Mus. No. 4343, Brevard, 2200 ft.

Fig. 6. *Spelerpes guttolineatus*, Am. Mus. No. 4348, Brevard, 2100 ft.

Fig. 7. *Spelerpes guttolineatus*, Am. Mus. No. 4498, Brevard, 2100 ft.

Fig. 8. *Spelerpes bislineatus*, Am. Mus. No. 4520, Grandmother Creek, Pineola, 3800 ft.

PLATE LX.

Fig. 1. *Spelerpes ruber schencki*, Am. Mus. No. 4458, Williams Creek, 2100 ft. Slightly under natural size.

Fig. 2. *Spelerpes guttolineatus*, Am. Mus. No. 4157, near Brevard, 2100 ft. Slightly under natural size.

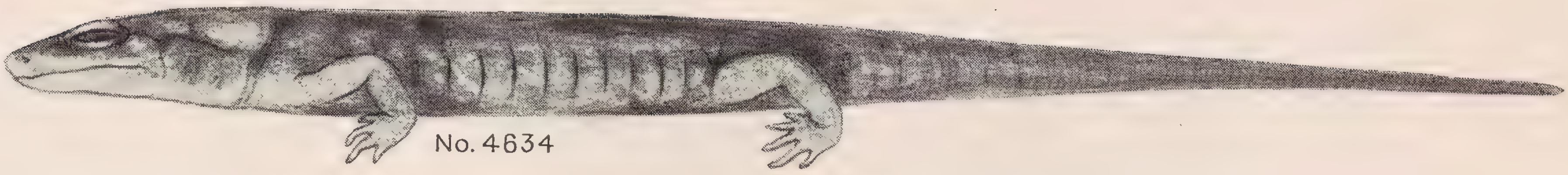
Fig. 3. *Spelerpes bislineatus*, Am. Mus. No. 4857, Linville, 4100 ft. $\frac{2}{3}$.

Fig. 4. *Spelerpes bislineatus*, Am. Mus. No. 4600, Linville, 4100 ft. $\frac{2}{1}$.

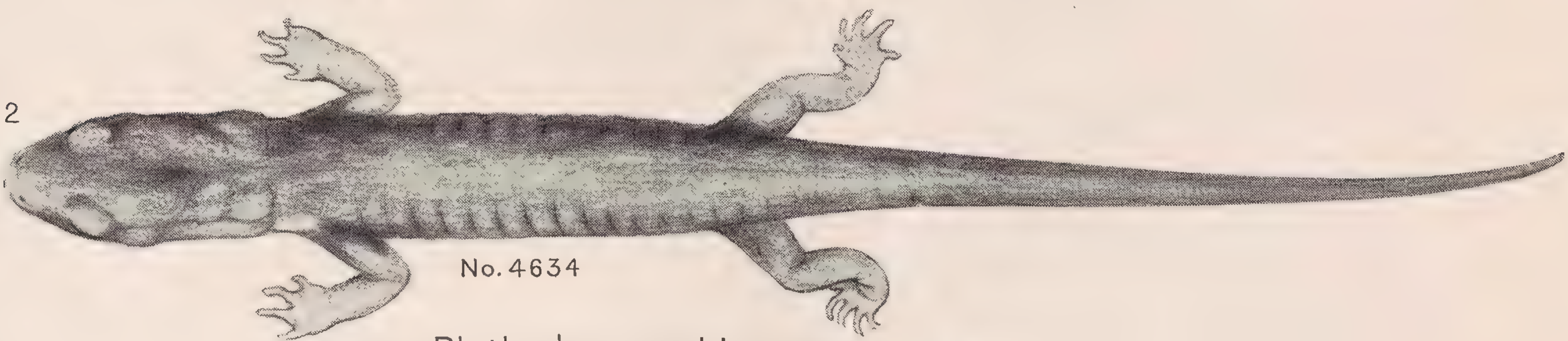
PLATE LXI.

Clemmys nuchalis, sp. nov. Type, Am. Mus. No. 8430, Yonahlossee Road, near Linville, North Carolina, altitude 4200 ft. $\frac{2}{1}$.

1

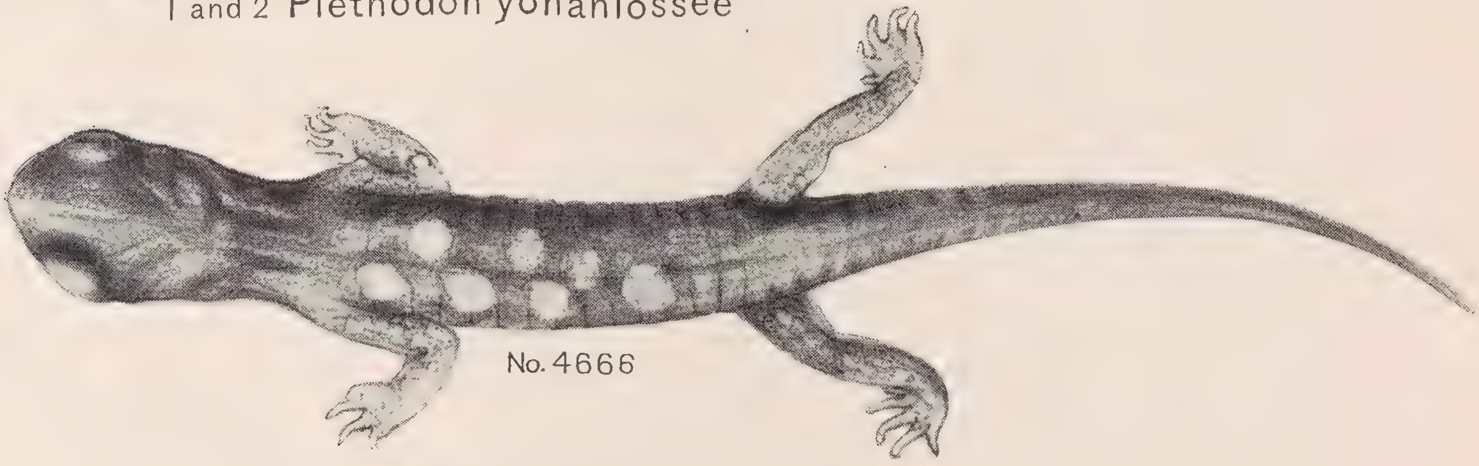


2



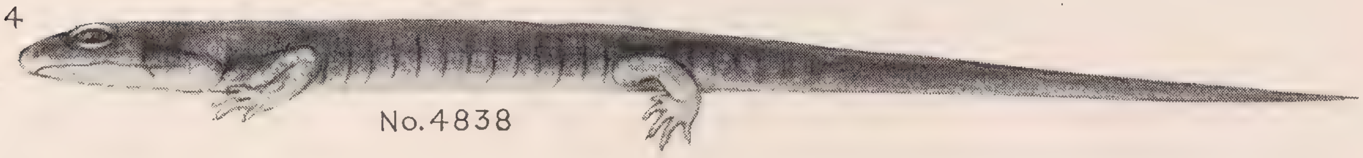
1 and 2 Plethodon yonahlossee

3



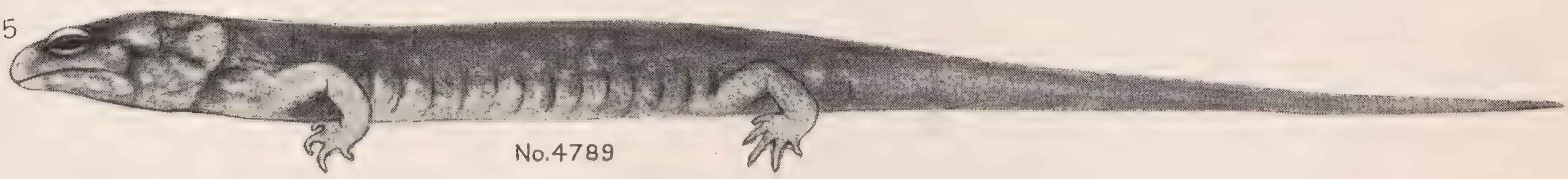
3 Plethodon yonahlossee

4



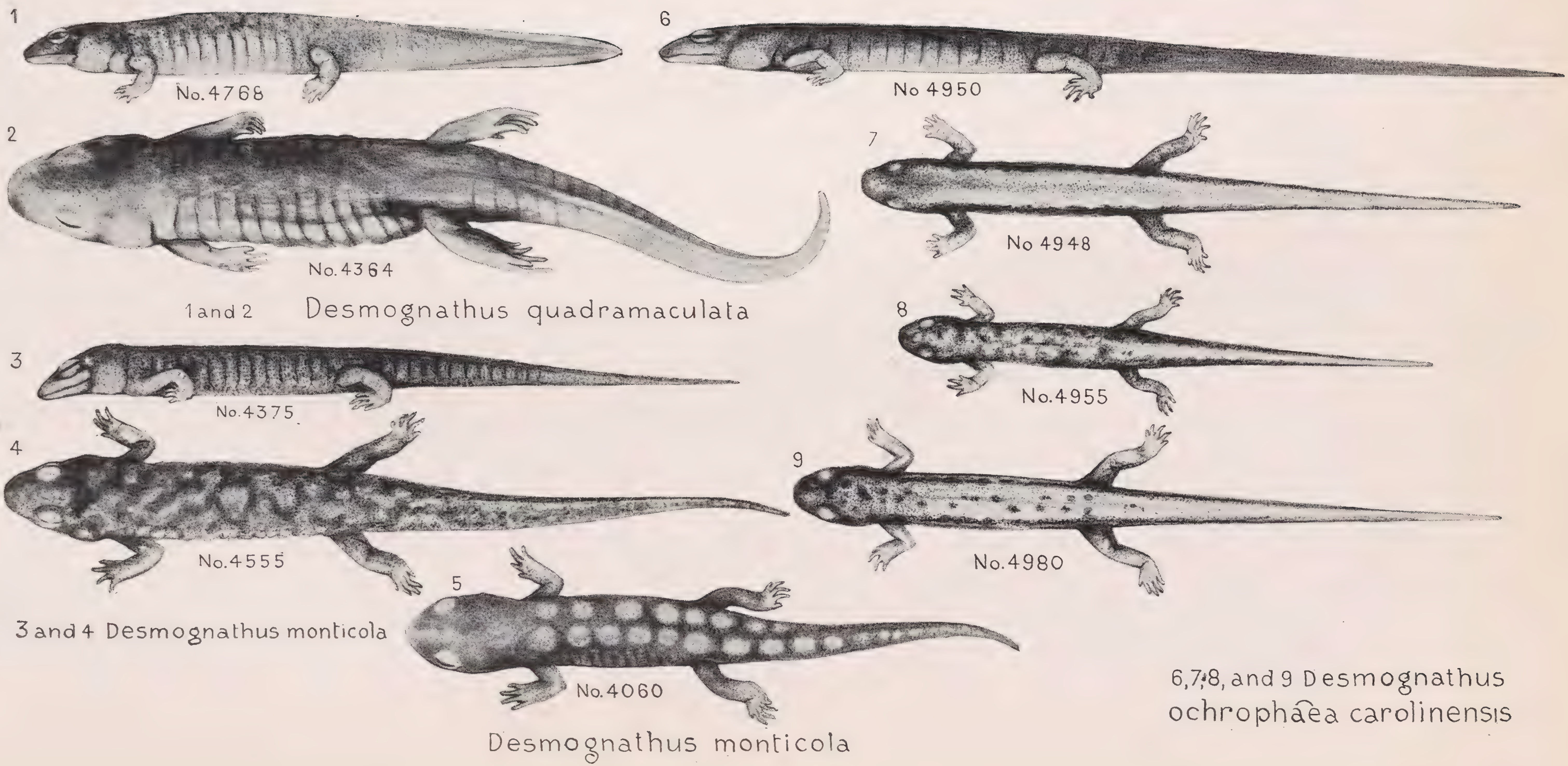
4 Plethodon metcalfi

5



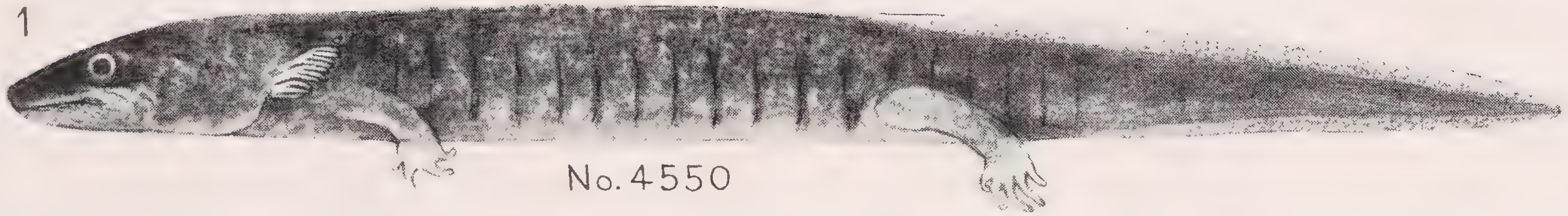
5 Plethodon glutinosus

SALAMANDERS FROM MOUNTAINS OF NORTH CAROLINA.


1
No. 4768
6
No 4950
2
No. 4364
7
No 4948
1 and 2 Desmognathus quadramaculata
8
3
No. 4955
No. 4375
4
9
No. 4555
No. 4980
5
3 and 4 Desmognathus monticola
No. 4060
6,7,8, and 9 Desmognathus ochrophæa carolinensis
Desmognathus monticola

SALAMANDERS FROM MOUNTAINS OF NORTH CAROLINA.

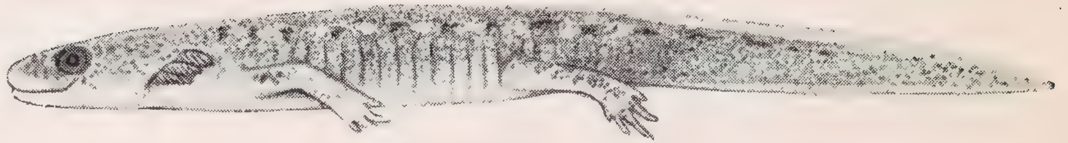
1



No. 4550

1 (x2) Desmognathus quadramaculata

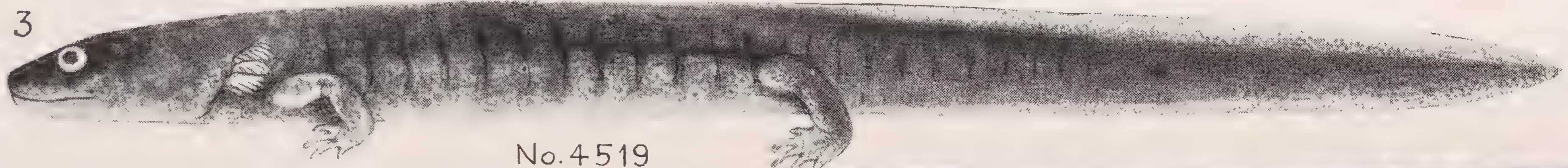
2



No. 4499

2 (x2) Spelerpes bislineatus

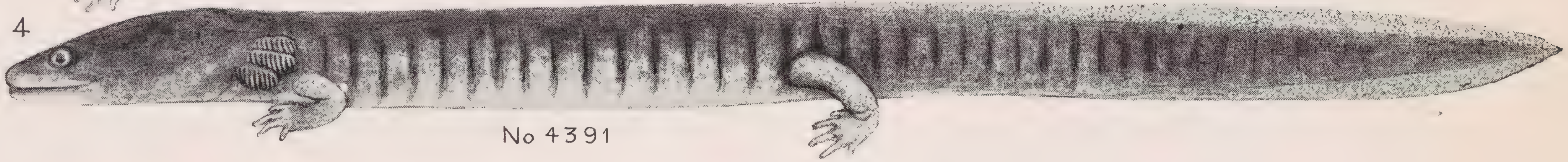
3



No. 4519

3 (x2) Leurognathus marmorata

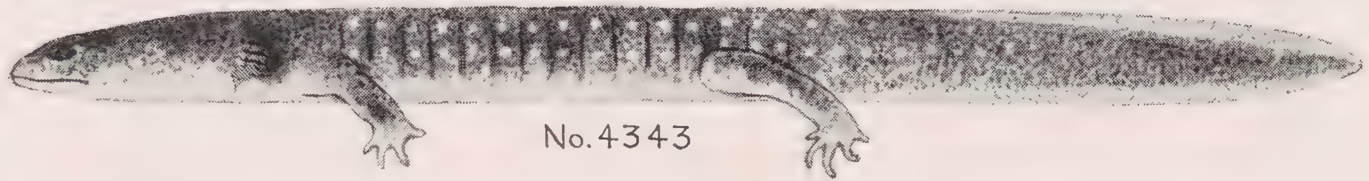
4



No 4391

4 (x2) Gyrinophilus danielsi

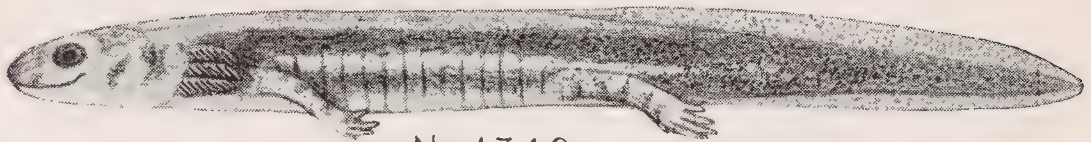
5



No. 4343

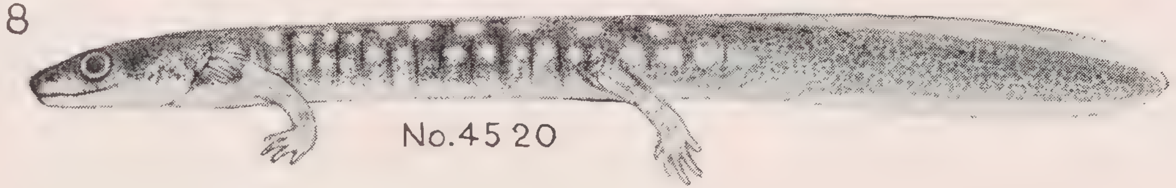
5 (x2) Spelerpes ruber schenki

6



No. 4348

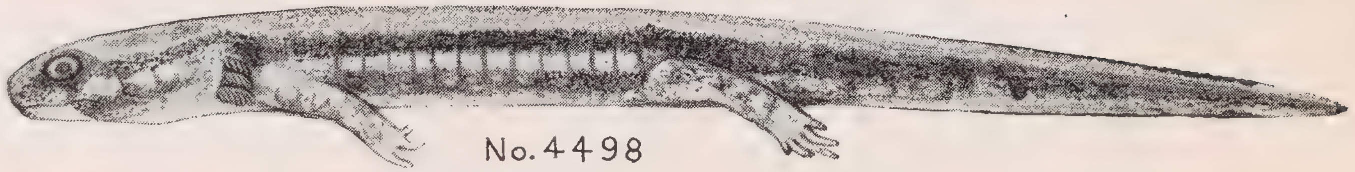
8



No. 4520

8 (x2) Spelerpes bislineatus

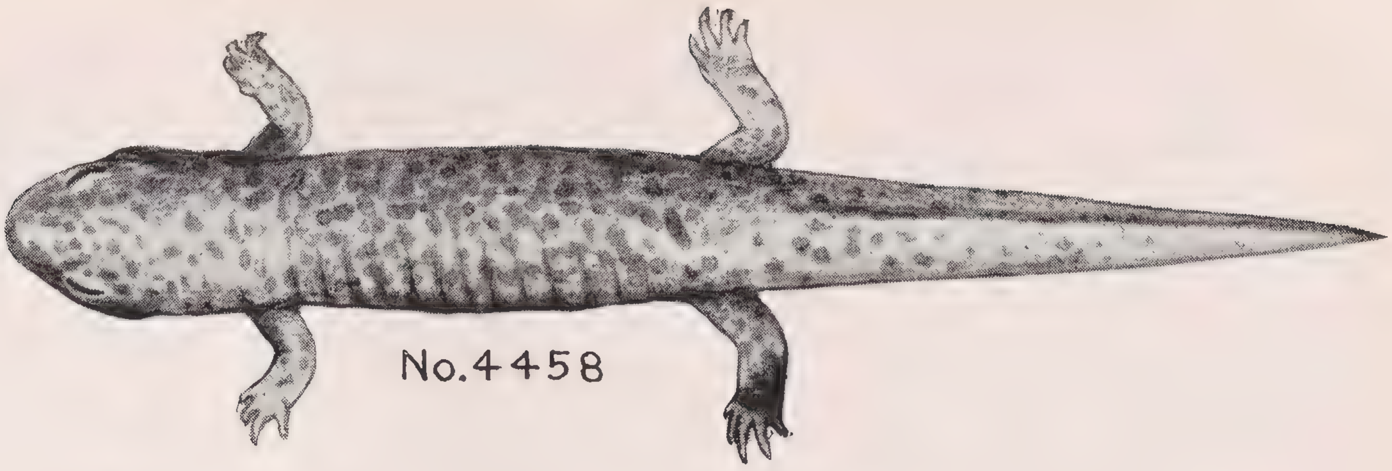
7



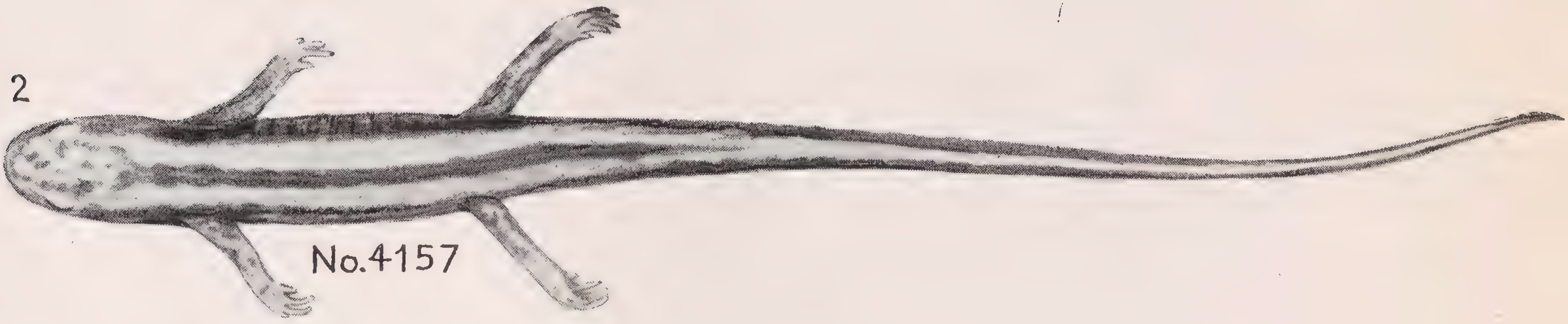
No. 4498

6 and 7 (x2) Spelerpes guttolineatus

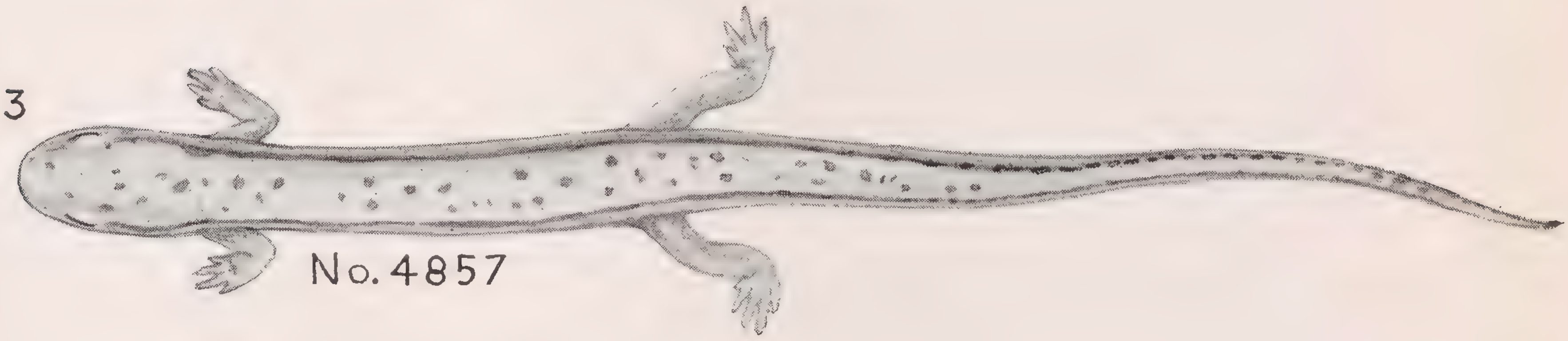
Larvæ of Salamanders from Mountains of North Carolina.



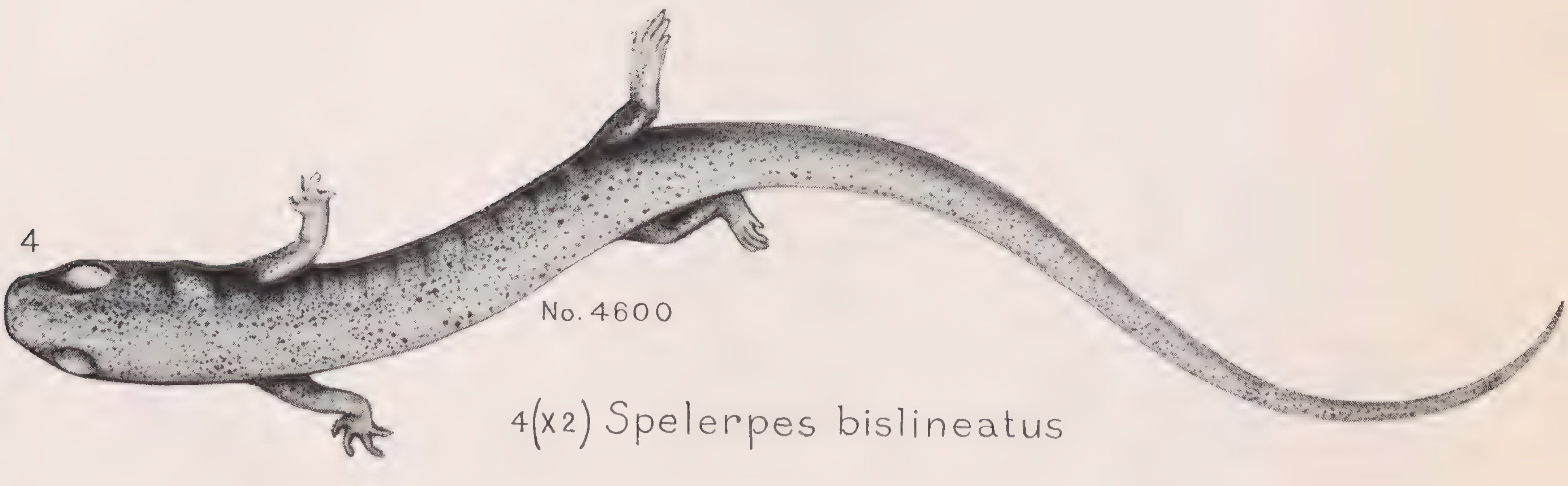
1 Spelerpes ruber schencki



2 Spelerpes guttolineatus

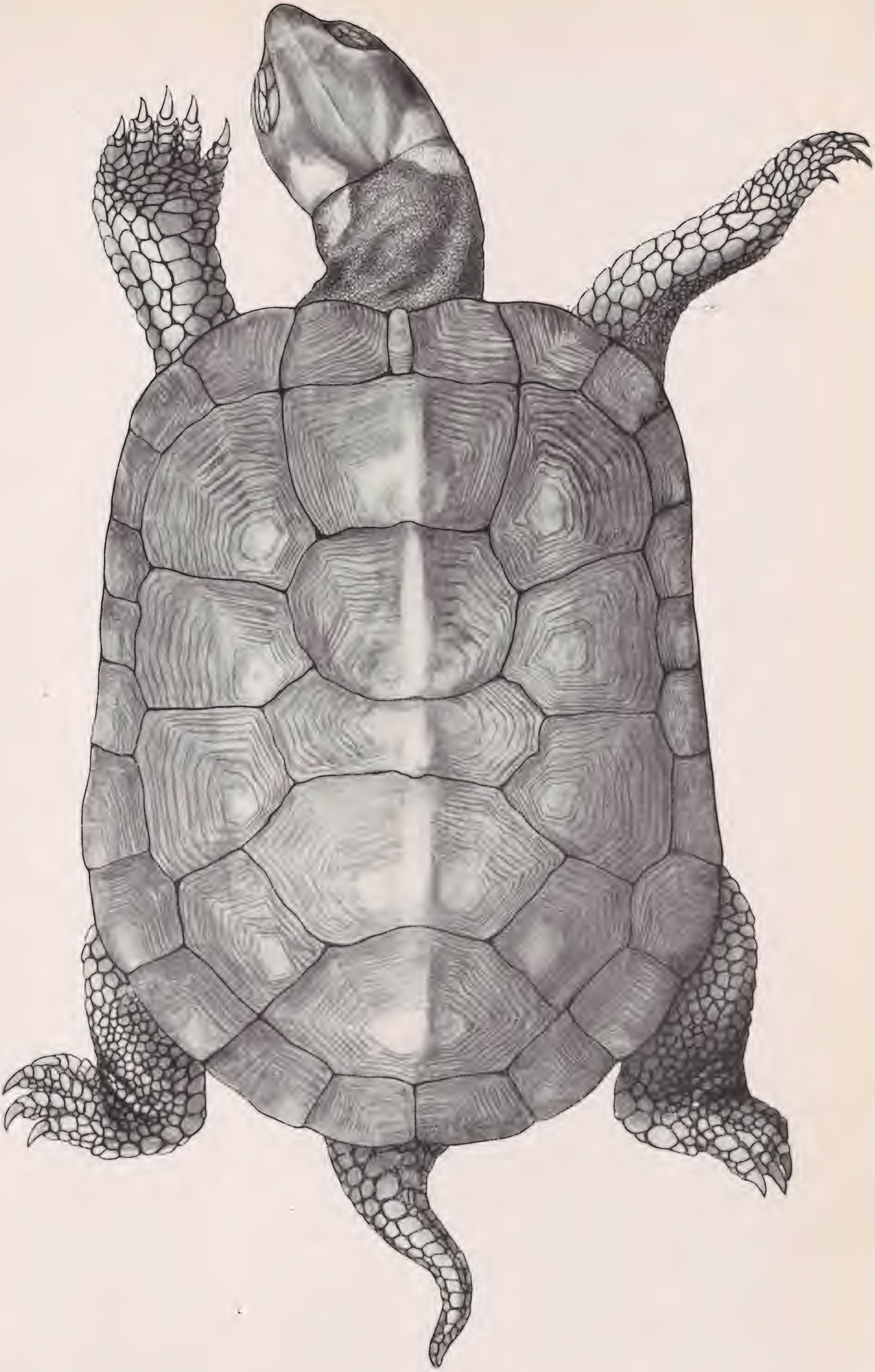


3 Spelerpes bislineatus



4(x2) Spelerpes bislineatus

SALAMANDERS FROM MOUNTAINS OF NORTH CAROLINA.



Clemmys nuchalis sp. nov. × 2.

59.57,21(729)

Article XXIV.— STUDIES IN WEST INDIAN EARWIGS (DERMAPTERA).

BY JAMES A. G. REHN AND MORGAN HEBARD.

PLATES LXII AND LXIII.

In recent years, extensive field work has been undertaken in the West Indies by the American Museum of Natural History. The present paper deals with the Dermaptera taken on these expeditions, excepting the material from Porto Rico, which will be separately treated. In addition, the West Indian material of the order collected by the junior author is included and also some few noteworthy other specimens in the Philadelphia collections, the United States National Museum, the Museum of Comparative Zoölogy and the Brooklyn Institute of Arts and Sciences. Our thanks are due to the curators of these institutions for the loan of this material.

The number of specimens treated is two hundred and forty-five, representing nine genera and fifteen[1] species, of which one genus and three species are here described as new. The West Indies are by no means rich in forms of Dermaptera, though individual species are sometimes found in great abundance. A number of the forms there found are, however, intensely interesting, owing to the fact that they are endemic. Eight species, nearly half of the total there found, are peculiar to the West Indies. Furthermore, the structure of some of the forms is very exceptional; this is true of *Formicilabia caribea*, *Cipex schwarzi*[2] and *Doru albipes*.

The distributional data in full for the species may be graphically indicated as follows:

Species	Greater Antilles	Lesser Antilles	Exotic
Pyragropsis buscki[3]	× Cuba	0	0
Psalis americana	×	0	Central and tropical South America
Anisolabis maritima	×	×	Cosmopolitan, temperate and tropical
Euborellia ambigua	×	×	Central America
Euborellia minuta	×	×	0
Euborellia annulipes	×	0	Cosmopolitan, temperate and tropical

---

[1] Seventeen species of Dermaptera are known from the regions under consideration.

[2] We have examined the material of this species previously recorded; no additional comment is at this time necessary.

[3] This species belongs to a genus also found in Central and tropical South America.

Species	Greater Antilles	Lesser Antilles	Exotic
Labidura bidens[1]	×	0	Temperate and tropical America
Labia curvicauda	×	0	Cosmopolitan, tropical
Labia dorsalis	0	Dominica ×	Central and tropical South America
Formicilabia caribea	× Hispaniola	0	0
Prolabia dominicae[2]	0	Dominica ×	0
Prolabia jamaicana[3]	× Jamaica	0	0
Prolabia unidentata	×	0	0
Prolabia arachidis[4]	×	0	Cosmopolitan, tropical
Cipex schwarzi[5]	× Cuba	0	0
Doru lineare	× Cuba	0	Southwestern United States to Central and tropical South America.
Doru albipes[6]	×	×	0

We would note that the length of body is given exclusive of the forceps. This method is uniformly followed in our studies in the Dermaptera.

PYGIDICRANIDÆ.

PYGIDICRANINÆ.

Pyragropsis buscki (*Caudell*).

1907. *Pyragra buscki* CAUDELL, Jour. N. Y. Ent. Soc., XV, p. 166. [Baracoa, Cuba.]

CUBA.—Santiago de Cuba, 1♂, [A. M. N. H.].

This is the third specimen recorded of this interesting species; it agrees fully with the type, except in having the pronotum buffy meso-laterad in a brief and narrow area, the tegmina proximad, and proximal half of the exposed portions of the wings, of the same color.

---

[1] A very closely related type is found throughout the temperate and tropical regions of the Old World.

[2] A closely related species is found in Trinidad.

[3] The species nearest allied to *jamaicana* and *unidentata* is found in the southeastern United States. No members of this group are known from the mainland of tropical America.

[4] We have this species, previously correctly recorded, in the West Indian material before us.

[5] We have examined the material previously recorded. No unrecorded material has been found.

[6] This is a type rather distinct from the other species of the genus found over North Central and South America.

LABIDURIDÆ.

PSALINÆ.

Psalis americana (*Beauvois*).

1817. *Forficula americana* BEAUVOIS, Ins. Recueil. Afr. Amér., p. 165, Orth. pl. 14, fig. 1. [San Domingo.]

CUBA.— Havana, 1♀, [A. N. S. P.]. (Large, antennæ yellowish without annuli, tegmina with large and decided orange suffusion, limbs yellowish.)

JAMAICA.— No exact locality, 3♀, 1 juv., [A. M. N. H.]. (Large, antennæ yellowish without annuli, tegmina with weak orange suffusion, limbs yellowish suffused with brown to varying degrees.)

HISPANIOLA.— Puerto Plata, San Domingo, III to IV, 1916, (N. L. Orme, Jr.), 1♂, 1♀, [A. M. N. H.]. La Vega, San Domingo, I, 1916 (C. Sebastian), 1♂, [Hebard Cln.]. (All large, antennæ yellowish without annuli, tegmina with weak orange suffusion, limbs yellowish.)

Five Porto Rican adults before us are entirely shining black, the antennæ with a white distal annulus, the wings projecting beyond the tegmina very briefly or entirely concealed. A sixth specimen at hand from that island is similar, but has the tegmina very weakly tinged mesad with orange.

Color variation and differences in the development in the organs of flight has led to the considerable synonymy of this plastic species. The names were based on the following conditions.

A. Tegmina unicolorous, dark.
B. Wings visible.
C. Wings strongly projecting. Limbs and antennæ rather dark.
(Hayti) *americana*
CC. Wings very slightly projecting. Limbs and antennæ very dark.
(Porto Rico) *gagathina*
(Porto Rico) *buscki*
BB. Wings entirely concealed. (Limbs and antennæ pale.)
(Ecuador) *robusta*
(Colombia) *colombiana*
AA. Tegmina with transverse yellowish-orange band. (Wings fully developed. Limbs and antennæ rather dark).
(West Indies) *procera*
(Cuba) *distincta*

Burr's *P. festiva*, described from Brazil, has the wings entirely concealed, the tegmina reduced, with a transverse yellowish-orange band. That insect, at present, is best considered distinct. The present species is widely distributed over northern South America, Central America and the West Indies.

Anisolabis maritima (*Géné*).

1832. *Forficula maritima* GÉNÉ, Sagg. Monogr. Forfic. Indig., p. 9. [Genoa, and Tuscany, Italy: Nice, France.]

CUBA.— 24 kilometers north of Vinales, Pinar del Rio, IX, 16 to 22, 1913, (C. W. Leng; under boards in mangrove swamp). 1 juv. ♂, [A. M. N. H.]. San Antonio de los Baños, Habana, IV, 9, 1905 (G. Dimmock), 1 juv., [U. S. N. M.].

DOMINICA.— No exact locality, IV, 26, 1910, 1 juv., [A. M. N. H.].

BARBADOS.—No exact locality, III, 27, 1910, 1♂, 2♀, 1 juv., [A. M. N. H.].

This cosmopolitan species does not appear to be abundant in the West Indies. It has been previously reported from the Bahamas, Porto Rico and Barbados.

Euborellia ambigua (*Borelli*).

1906. *Anisolabis ambigua* BORELLI, Boll. Mus. Zool. Anat. comp. Torino, XXI, No. 531, p. 3. [Jesús Maria River, Costa Rica.]

BAHAMAS.— Nassau, New Providence Island, II, 3, 1904, (M. Hebard; in limestone wall and under limestone boulders near Fort Charlotte), 2♂, 2♀, 1 juv. ♀,[1] [Hebard Cln. and A. N. S. P.]; V and VI, 1904, (W. M. Wheeler), 4♀, [A. M. N. H.]. Sisal Plantation, New Providence Island, VI, 26, 1904, 1♀, [A. M. N. H.].

CUBA.— Jesús Del Monte, Havana, I, 23, 1904, (M. Hebard; from pile of rubbish), 1♀,[2] [Hebard Cln.].

JAMAICA.— Stony Hill, St. Andrew Parish, X, 25, 1913, (M. Hebard; in leaves under jungle brush), 1♀, [Hebard Cln.]. Montego Bay, III, 6 and 15, 1911, (J. A. Grossbeck; under fermenting chowchow fruit and under dung), 1♂, 3♀, 2 large juv., [A. M. N. H.]; XI, 1 and 2, 1913, (M. Hebard; under bark on logwood docks), 1♂, [Hebard Cln.].

DOMINICA.— No exact locality, IV, 5, 1912, (in rotten wood), 1♂,[3] [A. N. S. P.]. Roseau, VI, 8 to 16, 1911, (Crampton and Lutz; under stone, on ground, at foot of palm), 1♂, 2♀, 1 large juv., [A. M. N. H.].

The species is also known from Porto Rico.[4] This series averages smaller than the types, which possibly is due to insular conditions, but not sufficient in degree to warrant racial distinction.

---

[1] Recorded by Rehn as *Anisolabis annulipes*, in 1906.

[2] Recorded by Rehn as *Anisolabis annulipes* in 1909.

[3] Recorded by Rehn as *Anisolabis janeirensis* in 1905.

[4] The insect recorded as common on St. Vincent by Brunner, as *janeirensis*, is probably this species.

We agree with Burr that antennal annulation is often a dangerous character, but in the present case find it to be constant, and, in consequence, we do not consider *ambigua* (without annuli) a synonym of *janeirensis* (with annuli). Of the smaller species of the Psalinæ represented by large series before us, we find antennal annuli invariably absent in *Anisolabis maritima* and *Euborellia ambigua*, invariably present in *Euborellia minuta* and *Euborellia annulipes*. The extremes in the series before us are: ♂, length of body, 8.2 to 12., length of forceps, 1.8 to 2.3; ♀, length of body 8.4 to 11., (in Porto Rican material the maximum is 13.5; in the Costa Rican types 16.), length of forceps, 2.2 to 2.7 mm.

Euborellia minuta (*Caudell*).

1907. *Anisolabis minuta* CAUDELL, Jour. N. Y. Ent. Soc., XV, p. 168. [Arroyo, and Mayaguez, Porto Rico.]

BAHAMAS.— Nassau, New Providence Island, 1♂, [Bklyn. Inst.]; II, 3, 1904, (M. Hebard; in limestone wall and under limestone boulders near Fort Charlotte), 3♂, 5♀,[1] [Hebard Cln. and A. N. S. P.]; V and VI, 1904, (W. M. Wheeler), 1♂ 1♀, [A. M. N. H.].

CUBA.— Marianao, Havana, I, 23, 1904, (M. Hebard; under stone in tangle of vines and shrubs), 1♂,[2] [Hebard Cln.]. Havana, XI, 5 and 6, 1915, (in University hall), 1♀, [A. M. N. H.]. San Antonio de los Baños, Habana, IV, 9, 1905, (G. Dimmock), 1♂, 1♀, [U. S. N. M.].

JAMAICA.— Montego Bay, III, 6 and 13, 1911, (J. A. Grossbeck), 2♂, 4♀, [A. M. N. H.]; XI, 1 and 2, 1913, (M. Hebard; under wood on logwood docks), 3♂, [Hebard Cln.]. Palm Beach, Montego Bay, III, 3, 1911, J. A. Grossbeck), 1♂, [A. M. N. H.].

BARBADOS.— No exact locality, XI, 10, 1903, (H. A. Ballou), 1♀,[3] [A. N. S. P.].

This insect is also common in Porto Rico. It is apparently the most numerous and generally distributed of the West Indian Psalinæ, which rather contradicts Burr's supposition that the typical material probably represented an accidental introduction of the East Indian *ståli*. The description of *ståli* shows that species to be larger (length of body 10 mm.), with forceps more elongate (length 2.5 mm.), than the largest of the considerable series of *minuta* now before us. The size difference is unimportant and that of the forceps would be a weak character for specific separation, but better knowledge of the Oriental *ståli,* we believe, will show these species to be distinct. The extremes of the present series are: ♂, length of body, 6.5 to 9., length of forceps, 1.4 to 1.7; ♀, length of body, 6.5 to 9.5, length of forceps, 1.4 to 2 mm.

---

[1] Recorded by Rehn as *Anisolabis annulipes*, in 1906.

[2] Recorded by Rehn as *Anisolabis annulipes*, in 1909.

[3] Recorded by Rehn as *Anisolabis janeirensis*, in 1905.

Euborellia annulipes (*H. Lucas*).

1847. *Forficelisa annulipes* Lucas, Bull. Soc. Ent. France, (2), V, p. XXXIV. [Jardin des Plantes, Paris, (probably introduced).]

Bahamas.— Little Golding Key, Andros Island, VI, 1904, (W. M. Wheeler), 1 large juv., [A. M. N. H.].

Jamaica.— Cinchona, II, 26, 1911, (J. A. Grossbeck), 1♀, [A. M. N. H.].

This cosmopolitan species, common in the southeastern United States, does not appear to be abundant in the West Indies, the majority of the records of this species from these islands being referable to *E. ambigua* and *E. minuta.*

Labidurinæ.

Labidura bidens (*Olivier*).

1791. *Forficula bidens* Olivier, Encycl. Méthod., Ins., VI, p. 466. [Jamaica.]

Bahamas.— Nassau, New Providence Island, 1♂, [Bklyn. Inst.].

Cuba.— 24 kilometers north of Vinales, Pinar del Rio, IX, 16 to 22, 1913, (under boards etc.), 1♀, [A. M. N. H.]. Guane, Pinar del Rio, IX, 24 to 26, 1913, 1♀, [A. M. N. H.].

The species is found on the American continent as far north as the southeastern United States. It is known in the West Indies also from Porto Rico.

The male from Nassau has the projections of the ultimate dorsal abdominal segment and disto-median tooth of the forceps weakly developed.

LABIIDÆ.

Labiinæ.

Labia curvicauda (*Motschulsky*).

1863. *Forficelisa curvicauda* Motschulsky, Bull. Soc. Nat. Moscou, XXXVI, pt. II, p. 2, pl. II, fig. 1. [Nura-Ellia Mountains, Ceylon.]

CUBA.— Cayamas, Oriente, VI, 11 to XII, (E. A. Schwarz), 1♂[1], 2♀[2], [U. S. N. M.]. Baracoa, VIII and IX, 15, 1901, (A. Busck), 3♀,[3] [U. S. N. M.].

HISPANIOLA.— Grande Anse, Hayti, (P. R. Uhler), 1♂, 1♀, [M. C. Z.].

JAMAICA.— Grange Lane, St. Catherine Parish, X, 25, 1913, (M. Hebard; under bark of dead limb of jungle tree, with *Prolabia unidentata*), 1♂, [Hebard Cln.].

There is little doubt but that the Cuban records of Gundlach and Bolivar, of *Labia arcuata* Scudder, apply to the present species.

This insect is widely distributed in the New World, though probably adventive in this hemisphere. A large series is before us from Long Key, Florida, and also examples from Utuado, Porto Rico; Corozal, Panama; Trinidad, and Pará, Brazil. In the latter country the species has been also reported from Santarem and São Paulo.

Labia dorsalis (*Burmeister*).

1838. *F[orficula] dorsalis* BURMEISTER, Handb. Ent., II, Abth. II, pt. I, p. 754. [Colombia.]

MONTSERRAT.— No exact locality, IV, 8 (H. G. Hubbard; under bark), 1♂, [U. S. N. M.].

Formicilabia,[4] new genus.

The present genus is readily separated from the species assigned to the genus *Labia* by the more slender form, more bulbous head, remarkably elongate and distinctively shaped pronotum, convexity of the dorsal surface of the tegmina and distinctive type of female forceps. The male will probably show other features of generic value.

The genus is monotypic. Genotype.— *Formicilabia caribea*, new species.

Form very slender. Head evenly convex, without trace of sutures. Eyes large, longer than cheeks. All but proximal antennal joints ovate. Pronotum very elongate and slender, broadening suddenly near the caudal margin, with this margin obtuse-angulate produced. Tegmina with dorsal surfaces convex. Female forceps strikingly triquetrous. Caudal metatarsus longer than combined length of second and third joints.

---

[1] Recorded by Burr in 1910 as *Labia trinitatis*.

[2] Recorded by Burr in 1910 as *Labia unidentata*.

[3] Recorded by Caudell in 1907 as *Labia* sp. The material recorded at that time as *Labia trinitatis* is before us. The female from Dominica represents an apparently undescribed species, nearest *Labia dorsalis*, the male from Trinidad, is the specimen which Burr in 1910 similarly misidentified.

[4] A member of the Labiinæ, but very ant-like in appearance.

Formicilabia caribea, new species.

Plate LXIII, Fig. 6.

1910. [*Labia*] *maeklini* Burr ("apparently new"), (not of Dohrn, 1864), Proc. U. S. Nat. Mus., XXXVIII, p. 455. (Specimen here considered.)

Of the described species which have been referred to *Labia*, *maeklini* is the only one showing any resemblance to the present insect. Dohrn's description is very inadequate, but the coloration is given as very different from that of the present insect. Burr's assignment carries little weight, as his treatment of the smaller American species referred to *Labia* in that paper is in large part incorrect, clearly due to hasty comparisons and deductions. The pronotal shape suggests that of *Solenosoma birmanum* (Bormans) as figured by Burr.[1]

Type: ♀; San Francisco Mountains, San Domingo. September, 1905. (A. Busck.) [U. S. National Museum.]

Size minute, form extremely slender. Head bulbous, much wider than greatest width of pronotum, nearly equalling width of tegmina across shoulders. Eyes very broad oval, distinctly longer than cheeks. Antennæ with first joint rather short and stout, hardly more than twice as long as broad, slightly less than combined length of second and third joints; second joint small, subquadrate; third pyriform; fourth ovate, three quarters as long as third; succeeding joints increasing in length distad, the longest about twice as long as broad. Pronotum very elongate and slender; surface feebly convex, but narrowly deplanate laterad and more broadly so caudad; lateral margins cingulate, parallel in proximal two-thirds, then slightly diverging, forming the broadly rounded latero-caudal angles, which project distinctly laterad; caudal margin obtuse-angulate produced. Tegmina with dorsal surface convex, caudal margins rather strongly oblique produced to sutural margins. Exposed portions of wings rather elongate. Ultimate dorsal abdominal segment large, slightly broader than long, with numerous minute rugæ on distal half of surface, which is weakly convex above bases of forceps and weakly concave meso-distad. Pygidium minute, declivent, triangular, with apex broadly truncate. Forceps strongly triquetrous; with dorsal, internal and ventral faces deplanate; dorso-internal margin cingulate, with numerous irregular rugæ proximad; ventro-internal margin more strongly cingulate throughout, but particularly proximad, with numerous, irregular, rounded teeth. Penultimate ventral abdominal segment strongly transverse, nearly rectangulate, with lateral margins broadly rounding into the broad, transverse, weakly concave distal margin, which is supplied with a thick fringe of short hairs.

Length of body, 3.26; of pronotum, .62; of tegmen, 1.16; of exposed portion of wing, along costal margin .68; of exposed portion of wing, along sutural margin, .5;

---

[1] Gen. Ins., Dermaptera, Fasc. 122, pl. v, fig. 20a.

of forceps, 1.09: width of abdomen, greatest, .8; of pronotum, cephalic, .41; of pronotum, caudal .54 mm.

Head shining blackish chestnut brown. Antennæ buffy, suffused with prout's brown. Pronotum and limbs light buff. Tegmina prout's brown, paler at angle formed by distal and sutural margins. Wings in exposed portions prout's brown, except large, irregularly subquadrate proximo-external areas, which are light buff. Abdomen buffy, suffused with prout's brown laterad, and with ultimate dorsal abdominal segment prout's brown. Forceps buffy suffused with brown, with internal margins and distal portion prout's brown.

The type of this remarkable species is unique.

Prolabia *Burr.*

This genus, like the genus *Labia,* includes a number of groups, some at least of which will certainly require generic separation. In the West Indies, the Dominicæ and Unidentata Groups are represented by several distinct species, that of the former showing some convergence toward the general type found in the Championi Group of the genus *Labia.* In addition to these forms, a single cosmopolitan species, *arachidis,* belonging to the Arachidis Group, is found in the West Indies.

Prolabia dominicæ, new species.

Plate LXII, Figs. 1 and 2; Plate LXIII, Fig. 2.

This species and *P. modesta* (Bruner) are the sole members of the Dominicæ Group, showing some convergence toward the Championi Group of the genus *Labia,* in the almost unarmed male forceps and type of male pygidium. The insect is quite as smooth, however, without any hairs on the forceps, as *P. unidentata,* and could easily, at first glance, be mistaken for a diminutive condition of that species. The distinctive form of the male pygidium shows nearest similarity to that of *Labia micans.* The male forceps are clearly a simplified condition of the *unidentata* type, evenly and very weakly curved, with only minute denticulations proximad on the ventro-internal margin. In the female sex of both *dominicæ* and *modesta* (Plate LXIII, Fig. 1) the forceps lack the large, blunt projection found in females of the species of the Unidentata Group.

The ultimate dorsal abdominal segment is distinctive in both sexes of the species.

Type: ♂; Long Ditton, Dominica. June 20, 1911. (F. E. Lutz.) [American Museum of Natural History.]

Size smaller than in *unidentata*, form similar. Head similar, with occiput smoothly rounded and faintly sub-bilobate. Antennæ with first joint not very elongate, but equal to combined length of second and third joints; fourth joint but very slightly longer than broad; succeeding joints weakly pyriform, longest about two and one half times as long as broad. Pronotum subquadrate; lateral margins subparallel, weakly cingulate; caudal margin feebly convex; prozona weakly convex, this continued weakly mesad on metazona to caudal margin, other portions of metazona deplanate. Tegmina about twice as long as pronotum[1]; wings fully developed, exposed portion about equal to length of pronotum. Abdomen smooth and shining; dorsal surface with distal segments, excepting ultimate segment, microscopically pitted, stink glands of third and fourth segments very weak; ultimate segment over twice as broad as long, caudal margin broadly and weakly convex at internal margin of forceps, between feebly concave, with margin thickened and supplied with a row of minute, bead-like projections (six in type), surface of segment, before this portion, feebly concave. Pygidium perpendicular as far as ventral surface of forceps, there suddenly horizontally produced, with lateral margins parallel and feebly thickened and distal margin evenly and strongly arcuate-emarginate, leaving the disto-lateral angles as acute points directed caudad.[2] Forceps moderately slender; shaft evenly and very weakly curved, internal face deplanate in proximal half, with dorsal margin very feebly thickened briefly proximad and ventral margin weakly thickened for slightly over half the distance to apex, this margin showing a few feeble denticulations in proximal portion, terminating in a minute, subobsolete tooth, a distance beyond the pygidium equal to the pygidial production. Penultimate ventral abdominal segment with distal margin convex, except beneath the pygidium, where it is moderately concave, thus appearing weakly bilobate. Limbs short; femora stout; caudal metatarsus about equal to combined length of second and third joints, ventral surface supplied with an internal row of minute spinulæ, with a few similar spinulæ adjacent proximo-mesad and an external thick fringe of minute hairs.

Allotype: ♀; same data as type. [American Museum of Natural History.]

Agrees with type except in the following features. Ultimate dorsal abdominal segment narrowing caudad, with meso-caudal depression more decided and concavity of distal margin between forceps more pronounced, but showing an exactly similar row of bead-like projections. Pygidium very small, strongly declivent, then vertical, with two microscopic, lateral points at the angle thus formed; minute disto-ventral portion subquadrate, with disto-lateral angles produced in microscopic points. Forceps stout, triquetrous, subcontiguous; shaft straight to weakly incurved apex, dorso-internal margin broadly rounded in proximal third, with two rows, each of a few microscopic rounded projections, thence obsolete, internal face concave in proximal third and supplied with microscopic pubescence, ventral margin lamellate, bluntly denticulate, nearly straight to near apex, with a single, minute, subobsolete tooth toward end of proximal third.[3] Penultimate ventral abdominal segment with distal margin convex, showing a feeble angulate tendency.

---

[1] In condition with wings not showing, about one and one-half times as long as pronotum.

[2] In some specimens the produced portion is slightly longer than wide, with lateral margins feebly convergent.

[3] In the species of the Dominicæ Group, the females have no large, blunt projection on the internal face of the forceps, just beyond the pygidium; this condition is strongly developed in the species of the Unidentata Group — *unidentata*, *pulchella* and *jamaicana*.

Measurements (in millimeters).

	Length of body	Length of pronotum	Length of tegmen (wings showing)	Length of tegmina (wings concealed)	Length of forceps
♂					
Type	5.	.9	1.8	——	2.3
Paratypes (7)	4.7–5.2	.8–1.	1.6–1.7	1.2–1.6	1.8–2.4
♀					
Allotype	5.8	1.1	2.	——	1.9
Paratypes (10)	5.2–6.	1.–1.2	1.7–1.9	1.4–1.7	1.7–2.

General coloration shining auburn, tinged with chestnut on abdomen. Head and lateral portions of abdomen shining blackish brown. Proximal antennal joints ochraceous-buff, other joints dark. Pronotum auburn, buffy narrowly laterad. Limbs ochraceous-buff, the femora suffused dorsad with auburn. Though normally the tegmina and exposed portions of the wings are solid auburn, the latter show, in occasional specimens, a buffy line at the tegminal extremities.

The immature examples before us have the pronotum pale, except narrowly caudad, where it is dark. This is a condition found in adults of certain species of *Labia* and, from the present material, would indicate possibly the survival of a primitive type in adults of those species.

Specimens examined: 33; 8 males, 11 females and 14 immature examples.

Dominica.— Long Ditton, VI, 17 to 20, 1911, (Lutz and Miner; under bark of decaying logs and in black forest soil), 8♂, 9♀, *type, allotype, paratypes*, 12 juv., [A. M. N. H.]. Laudet, VI, 10 and 13, 1911, 2650 feet, (F. E. Lutz; in friable rock of crater of boiling lake), 2♀, *paratypes*, 2 juv., [A. M. N. H.].

Prolabia jamaicana, new species.

Plate LXII, Figs. 3 and 4; Plate LXIII, Fig. 3.

The present species is the largest known of the Unidentata Group. It shows nearest relationship to *P. unidentata*, differing in the decidedly larger size, beautifully and distinctively pitted ultimate dorsal abdominal segment, distinctive male pygidium and forceps of both sexes, which, though of generally similar character, show differences of diagnostic value.

Type: ♂; Mandeville, Manchester Parish, Jamaica. November 6, 1913. (M. Hebard.) [Hebard Collection Type No. 438.]

Size large for the group, form much as in *unidentata*. Head similar, but with occiput showing hardly a trace of bilobation, its caudal margin transverse. Antennæ with joints more elongate; first joint equalling combined length of second and third; fourth about half again as long as broad; succeeding joints elongate pyriform, longest about three times as long as broad. Pronotum similar to that of *unidentata*, slightly longer than broad, but otherwise as described for *P. dominicæ*. Tegmina about one and one-half times as long as pronotum, caudal margin transverse with angles sharply rounded.[1] Abdomen smooth and shining proximad; fifth to ninth dorsal segments

---

[1] In none of the adults before us are wings apparent.

becoming increasingly heavily but finely pitted caudad, these pits fusing toward the caudal margins of the distal segments, forming irregular, impressed, longitudinal lines; stink glands of third and fourth segments very weak; ultimate segment over twice as broad as long, surface finely pitted, except for a narrow, elongate, proximo-longitudinal area latero-dorsad and a broader area mesad, which areas are smooth, a very brief medio-longitudinal sulcus is sharply defined meso-distad and in the distal area minute, bead-like projections are scattered through the numerous microscopic pits and rugæ, the caudal margin is very briefly and weakly convex at the internal margins of the forceps, between very feebly convex. Pygidium large, strongly declivent in brief proximal portion; remaining portion subquadrate, weakly declivent, with surface convex, latero-ventral margins feebly convex to a minute, bead-like, mesal projection, thence feebly convex and convergent to the acute-angulate disto-lateral angles, between which the caudal margin is moderately angulato-concave.[1] Forceps much as in *unidentata*, but somewhat simplified, with the moderately conspicuous tooth less distal in position; shaft with inner surface deplanate to this tooth,[2] dorso-internal margin rounded and unarmed, ventral margin lamellate and serrulate in proximal half, terminating in a subobsolete tooth,[3] just before the distal tooth the shaft suddenly broadens and thence is weakly flattened and narrows very gradually to the slightly incurved, blunt apex. Penultimate ventral abdominal segment with lateral margins feebly convex and convergent, rounding into a broad but weak concavity below the pygidium, thus bilobation is even more faintly suggested than in *dominicæ*. Limbs short; femora stout; metatarsus as in *dominicæ*.

Allotype: ♀; same data as type. [Hebard Collection.]

Agrees with type except in the following features. Ultimate dorsal abdominal segment narrowing caudad, but with pitted and smooth areas and distal specialization similar. Pygidium very small, vertical; minute disto-ventral portion with disto-lateral angles acutely and minutely produced laterad and distal margin feebly convex. Forceps stout, triquetrous, subcontiguous; shaft straight to weakly incurved apex, dorso-internal margin in proximal two-thirds broadly rounded, with a proximal, heavy, bluntly bidentate projection, succeeded by a row of a few, microscopic, blunt projections toward the internal face, internal face concave in proximal two-thirds and supplied with short, straight, microscopic hairs, ventro-internal margin lamellate, bluntly denticulate, nearly straight to apex, with a slightly heavier tooth proximad and another similar tooth at end of proximal third. Penultimate ventral abdominal segment with distal margin angulato-convex.

Measurements (in millimeters).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Length of forceps
Mandeville. *Type*	8.8	1.3	1.2	1.8	3.1
Cinchona. *Paratypes* (6)	8.8–10.8	1.4–1.7	1.2–1.6	1.8–2.1	3.6–4.1
♀					
Mandeville. *Allotype*	9.8	1.8	1.7	2.	2.8
Cinchona. *Paratypes* (2)	10.6–11.1	1.9–1.8	1.8–1.7	2.1–2.2	3.6–3.3

---

[1] The width of the caudal margin varies in the series before us, from distinctly more, to distinctly less than half the mesal width of the pygidium; the pygidium is also produced to different degrees, but its distinctive form, described above, is never changed.

[2] In the series situated from one half to three fifths the distance from base to apex.

[3] In some specimens the distal tooth is well developed and this tooth is distinct, though small.

General coloration dark and shining. Head blackish chestnut. Antennæ prout's brown. Pronotum and tegmina mummy brown. Abdomen and forceps mahogany red, the abdomen becoming darker proximad. Femora prout's brown, tibiæ and tarsi ochraceous-buff. In one female the ultimate dorsal abdominal segment and forceps are strikingly paler, vinaceous-rufous. This condition is even more conspicuously shown in the immature examples before us.

Specimens examined: 24; 7 males, 3 females and 14 immature individuals.

JAMAICA.— Cinchona, II, 25, 1911 (J. A. Grossbeck), 6♂, 2♀, *paratypes*, 11 juv., [A. M. N. H.]. Mandeville, XI, 6, 1913, (M. Hebard; on ground under log in upland pasture, under the bark of this same log was a colony of *Prolabia unidentata*), 1♂, 1♀, *type*, *allotype* [Hebard Cln.]. Montego Bay, III, 15, 1911, (J. A. Grossbeck; taken by sweeping), 2 juv., [A. M. N. H.]; XI, 3, 1913, (M. Hebard; in dead agave in dense hillside jungle scrub), 1 juv., [Hebard Cln.]. No exact locality, 1♂[1], [U. S. N. M.].

Prolabia unidentata (*Beauvois*).

1805. *Forficula unidentata* BEAUVOIS, Ins. Recueil. Afr. Amér., p. 165, pl. XIV, fig. 3. [San Domingo.]

BAHAMAS.— Nassau, New Providence Island, II, 3, 1904, (M. Hebard; near Fort Charlotte), 1 juv., [Hebard Cln.].

CUBA.— Cayamas, Oriente, VIII, 3, (Schwarz; Baker), 2♂, 1♀,[2] [A. N. S. P.]. San Carlos Estate, Guantanamo, X, 4 to 8, 1913, (in and under rotten logs), 2♀, 3 juv., [A. M. N. H.].

HISPANIOLA.— San Francisco Mountains, San Domingo, IX, 4 to 27, 1905, (A. Busck), 4♂, 4♀,[3] [U. S. N. M.].

JAMAICA.— Botanical Gardens, XI, 13, 1902, 1♀,[4] [U. S. N. M.]. Grange Lane, St. Andrew Parish, X, 25, 1913, (M. Hebard; under bark of dead limb of jungle tree), 3♂, 3♀, [Hebard Cln.]. Mandeville, XI, 6, 1913, (M. Hebard; under bark of log in upland pasture), 4♂, [Hebard Cln.]. Montego Bay, XI, 1 and 2, 1913, (M. Hebard), 1 juv., [Hebard Cln.].

In the present series, one from Guantanamo, seven from the San Francisco Mountains and two from Grange Lane, have fully developed wings, showing a buffy proximal spot. Five adults of the species from Porto Rico are before us, of which one male and two females show this condition.

Compared with the extensive series from the southeastern United States before us, we find that the mainland insect is a different species, the male pygidium being particularly distinctive. Thus the name which must be employed for the mainland insect is *Prolabia pulchella* (Serville), (Plate LXII, Figs. 7 and 8; Plate LXIII, Fig. 5), under which, and not under *unidentata*, must be placed the synonyms *guttata, burgessi* and *melancholica*. These two species are very similar in general appearance and both show two conditions, one with wings not showing, the other with wings fully developed and with a buffy proximal spot. Burr's conclusion that these two species were not distinguishable is proven erroneous by the series now at hand. With more material, that author could hardly have failed to recognize the fact that in the Labiinæ great numbers of species exist, many showing general superficial similarity to their nearest allies. In the Unidentata Group the form of the male pygidium is distinctive and constant in all of the species.

---

[1] Recorded by Burr in 1910 as *Prolabia unidentata*.

[2] Recorded by Rehn as *Labia brunnea*, in 1909.

[3] Of this series Caudell, in 1907, recorded a male as *Labia pulchella* and three females as *Labia brunnea*.

[4] Recorded, in 1907, by Caudell as *Labia gravidula*.

The characters of chief importance in the male sex of *unidentata* are as follows:

(San Francisco Mountains, San Domingo.) Size medium small for the group, form moderately slender. Head smooth, occiput smoothly rounded and sub-bilobate. Antennal joints much as in *P. dominicæ*, but with distal joints elongate pyriform, with a fusiform tendency. Ultimate dorsal abdominal segment almost perfectly smooth, a very faint creasing of the surface indicated in the areas which in *P. jamaicana* are strikingly defined by punctæ; caudal margin between forceps smooth, transverse. Pygidium feebly declivent, with surface convex; slightly longer than broad; lateral margins subparallel and feebly tuberculate to minute disto-lateral angles, distal margin with lateral portions straight, convergent, to brief median portion, which is briefly and very weakly obtuse-angulate emarginate. Forceps much as described for *jamaicana*, but with contour more decided; tooth of ventral margin just before end of proximal third, heavy; internal surface feebly convex from there to feeble distal tooth, which is situated slightly less than half the distance from the proximal tooth to the apex. Penultimate ventral abdominal segment with distal margin showing scarcely any median emargination.

In the series of males before us we find that the forceps vary conspicuously in the development of contour, occasional specimens showing much more simple forceps than is usual. Such variation occurs in all the species of the Unidentata Group and is strikingly shown in many other forms of the Dermaptera.

FORFICULIDÆ.

Forficulinæ.

Doru lineare (*Eschscholtz*).

1822. *Forficula linearis* Eschscholtz, Entomogr., p. 81. [Santa Catharina, Brazil.]

Cuba.—7 kilometers north of Vinales, Pinar Del Rio, IX, 16 to 22, 1913, (in meadow grasses and those growing about water hole), 11♂, 9♀, 8 juv., [A. M. N. H.]. Pinar del Rio, Pinar del Rio, IX, 9 to 24, 1913, (weeds and grasses in meadow), 4♂, 1♀, [A. M. N. H.]. Cerro Cabras, Pinar del Rio, IX, 11, 1913, (sedges in moist place, weedy yard), 7♂, 3♀, 16 juv., [A. M. N. H.]. Cabañas, Pinar del Rio, IX, 5 to 8, 1913, 1♀, 3 juv., (A. M. N. H.]. Zaza de Media, Santa Clara, IX, 30, 1913, (Lutz; along track through cane fields), 2♂, 3♀, 1 juv., [A. M. N. H.]. Santiago de Cuba, 2♂, 1♀, [A. M. N. H.].

These specimens, for the species, are all of medium to rather slender build. The males have the medio-distal tooth of the forceps moderately decided in five, small in nine, small on one side and absent on the other in two, and absent in eight. The extremes are: length of body, ♂, 8.3 to 12.7, ♀, 8.7 to 12.1; length of forceps, ♂, 3.7 to 5.8, ♀, 2.9 to 3.3 mm. The male pygidium shows scarcely any variation.

The distribution of this widespread insect is extremely interesting. It is abundant throughout tropical South America, extending northward on the continent as far as the southwestern United States, but is not found east of Brownsville, Texas, in that country. In the West Indies, it is known only from Cuba, where Gundlach has already reported it everywhere common.

Doru albipes (*Fabricius*).

Plate LXIII, Figs. 7–10.

1787. *F[orficula] albipes* Fabricius, Mantissa Ins., I, p. 224. [West Indies.]

1817. *Forficula bimaculata* Beauvois, Ins. Recueil. Afr. Amér., p. 165, Orth. pl. XIV, fig. 2. [San Domingo.]

1911. *P[haulex] albipes* Burr, Gen. Ins., Dermapt., p. 78. (New genus described.)

1911. *D[oru] bimaculatum* Burr, *ibid.*, p. 79. (Assignment of Beauvois' name.)

Virgin Islands.— Charlotte Amalie, St. Thomas, VI, 3, 1911, (F. E. Lutz; grassy and herbaceous roadside), 1 juv., [A. M. N. H.]. Christiansted, St. Croix, VI, 3, 1911, (F. E. Lutz; sweeping along road near harbor), 1♂, [A. M. N. H.].

Dominica.— Roseau, VI, 23, 1911, (F. E. Lutz), 1 juv., [A. M. N. H.]. Laudet, VI, 11, 1911, (F. E. Lutz; beating moss-covered branches of lime trees), 1♂, 1 very small juv., [Hebard Cln.].

In addition, there are now before us from Porto Rico, three males, ten females and four immature examples. The series at hand, though not extensive, proves conclusively the synonymy of Beauvois's *bimaculata*. The pronotal coloration ranges from dark, with caudal portion nearly white (as described for *albipes*), to solidly yellowish (as figured for *bimaculata*).

Conditions variously intermediate between these extremes are also represented.

Burr's action in separating the species as a distinct genus, *Phaulex,* is unwarranted; the characters given being invalid and no features existing of generic value. The slenderness of the first and third tarsal joints varies individually but not decidedly, the different degrees found in the present series being easily matched in the very extensive series before us of *Doru lineare.* The pronotum is found to vary from slightly broader than long (normal), to slightly longer than broad; this is of neither generic or specific value. The pygidium of the males of this species has a distinct spine, heavier and shorter than in *lineare,* it is true; the contradiction of this feature in the description of *Phaulex,* we can only ascribe to the probability that, when the evidently hurried diagnosis was drawn up, females only were at hand. The forceps of *albipes* are indeed stouter and more depressed than in *lineare* (the dorsal surface being deplanate in males, with lateral margins raised and moderately cingulate), this condition being of excellent specific diagnostic value, but having not the least generic significance. It is particularly surprising to find such diversity of assignment of names applicable to the same species, when we note Burr's almost contemporaneous suggestion that "perhaps *albipes* and *bimaculata* are identical." [1]

The three adult males before us are each different in general appearance. The one from Christiansted is heavier, with coloring more contrasted, than the one from Adjuntas, Porto Rico. The male from Laudet is much larger, dark in coloration, the characteristic pale markings apparently obscured by discoloration, while the pronotum is slightly longer than broad. The ultimate dorsal abdominal segment in these males bears four heavy, blunt projections mesad at the caudal margin.

The distinctive color pattern of this species is shown by the figure.

Measurements (in millimeters).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Length of forceps
Adjuntas, Porto Rico	9.7	1.3	1.4	2.6	2.8
Coamo Springs, Porto Rico (2)	10.–11.7	1.6–1.75	1.7–1.85	2.8–3.4	3.7–4.1
Christiansted, St. Croix	10.7	1.7	1.8	3.1	3.7
Laudet, Dominica	15.	2.1	2.	3.3	4.7
♀					
Mayaguez, Porto Rico	9.7	1.65	1.7	2.9	2.8
Adjuntas, Porto Rico	9.8	1.65	1.75	3.2	2.7
Aibonito, Porto Rico	8.7	1.4	1.55	2.8	2.6
Coamo Springs, Porto Rico (7)	9.4–11.3	1.4–1.7	1.45–1.8	2.6–3.1	2.2–2.8

---

[1] Proc. U. S. Nat. Mus., XXXVIII, p. 464, (Aug. 20, 1911). Genera Insectorum dated July 15, 1911.

EXPLANATION OF PLATES LXII AND LXIII.

Plate LXII.

Figures of pygidia all greatly magnified.

Fig. 1. *Prolabia dominicæ,* new species. ♂, *type.* Long Ditton, Dominica. Dorsal outline. (× 9)

Fig. 2. *Prolabia dominicæ* new species. ♂, *type.* Long Ditton, Dominica. Dorsal view of pygidium.

Fig. 3. *Prolabia jamaicana,* new species. ♂, *type.* Mandeville, Jamaica. Dorsal outline. (× 6.1)

Fig. 4. *Prolabia jamaicana,* new species. ♂, *type.* Mandeville, Jamaica. Dorsal view of pygidium.

Fig. 5. *Prolabia unidentata* (Beauvois). ♂. San Francisco Mountains, San Domingo. Dorsal outline. (× 8.6)

Fig. 6. *Prolabia unidentata* (Beauvois). ♂. San Francisco Mountains, San Domingo. Dorsal view of pygidium.

Fig. 7. *Prolabia pulchella* (Serville). ♂. Thomasville, Georgia. Dorsal outline. (× 6.5)

Fig. 8. *Prolabia pulchella* (Serville). ♂. Thomasville, Georgia. Dorsal view of pygidium.[1]

Plate LXIII.

Fig. 1. *Prolabia modesta* (Bruner). ♀, *type.* Trinidad. Dorsal view of ultimate dorsal abdominal segment and forceps. (× 9)

Fig. 2. *Prolabia dominicæ,* new species. ♀, *allotype.* Long Ditton, Dominica. Dorsal view of ultimate dorsal abdominal segment and forceps. (× 10.8)

Fig. 3. *Prolabia jamaicana,* new species. ♀, *allotype.* Mandeville, Jamaica. Dorsal view of ultimate dorsal abdominal segment and forceps. (× 7.3)

Fig. 4. *Prolabia unidentata* (Beauvois). ♀. San Francisco Mountains, San Domingo. Dorsal view of ultimate dorsal abdominal segment and forceps. (× 9)

Fig. 5. *Prolabia pulchella* (Serville). ♀. Thomasville, Georgia. Dorsal view of ultimate dorsal abdominal segment and forceps. (× 8.7)

Fig. 6. *Formicilabia caribea,* new species. ♀, *type.* San Francisco Mountains, San Domingo. Dorsal view. (× 12.7)

Fig. 7. *Doru albipes* (Fabricius). ♂. Coamo Springs, Porto Rico. Dorsal view. (× 5.4)

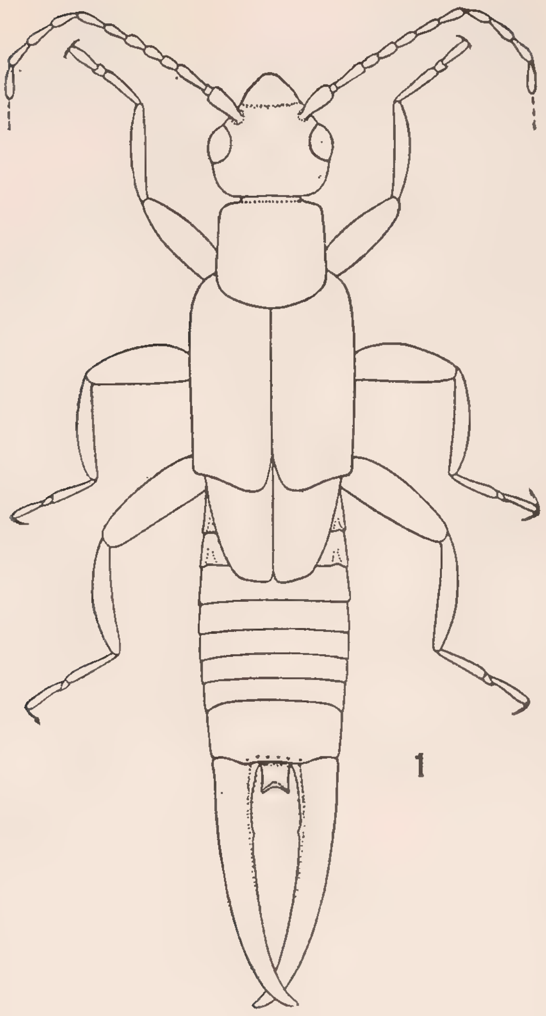
Fig. 8. *Doru albipes* (Fabricius). ♂. Coamo Springs, Porto Rico. Dorso-caudal view of pygidium. (Greatly magnified).

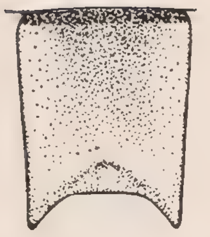
Fig. 9. *Doru albipes* (Fabricius). ♀. Coamo Springs, Porto Rico. Dorsal view of ultimate dorsal abdominal segment and forceps. (× 9.4)

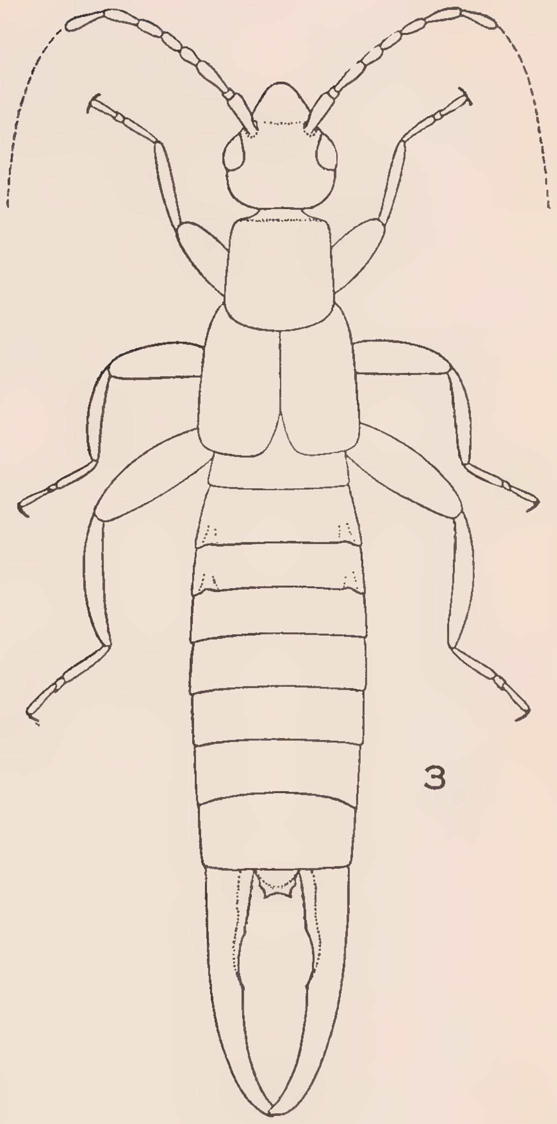
Fig. 10. *Doru albipes* (Fabricius). ♀. Coamo Springs, Porto Rico. Dorso-caudal view of pygidium. (Greatly magnified).

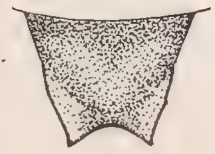
---

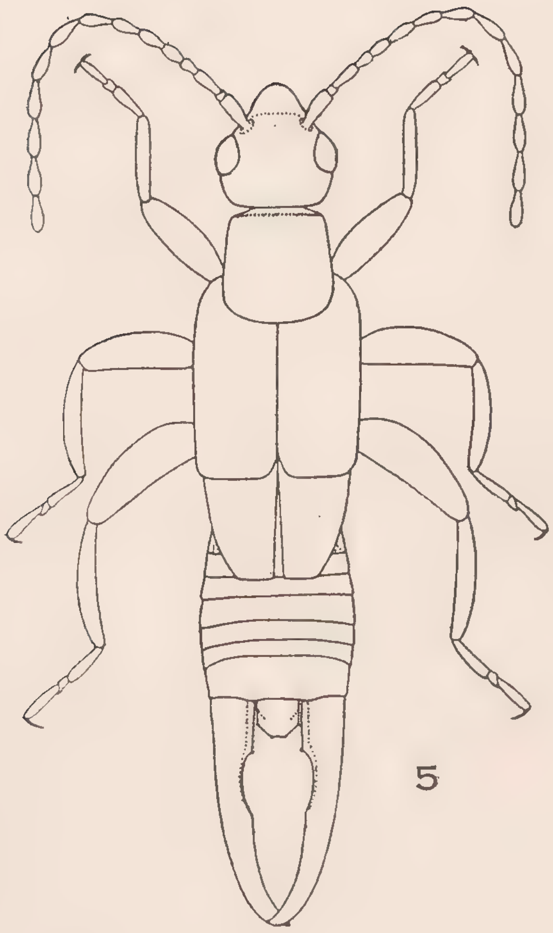
[1] In this species the pygidium is declivent, so that, taking the whole insect into consideration, this would be a dorso-caudal view.

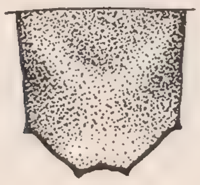

1

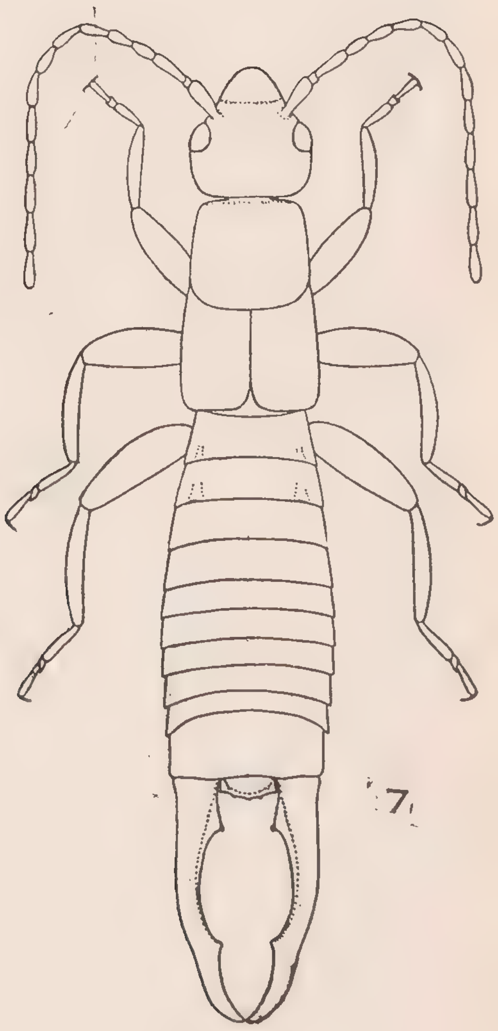

2

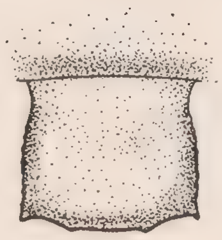

3


4

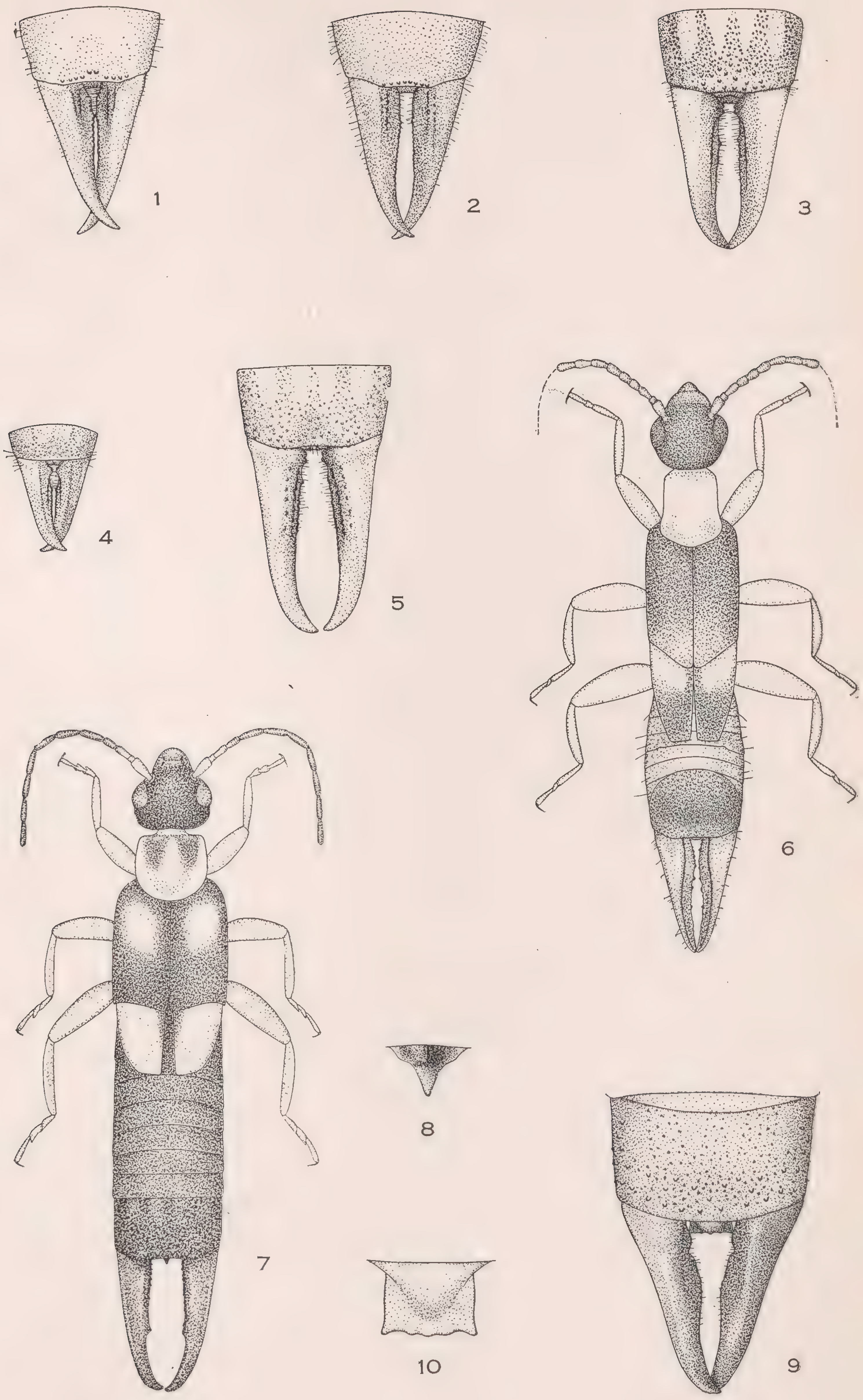

5


6


7


8

WEST INDIAN EARWIGS (DERMAPTERA).



West Indian Earwigs (Dermaptera).

Article XXV.— FRESH-WATER FISHES OF THE CONGO BASIN OBTAINED BY THE AMERICAN MUSEUM CONGO EXPEDITION, 1909–1915.[1]

By John Treadwell Nichols and Ludlow Griscom.

With field notes by the collectors, Herbert Lang and James P. Chapin.

Plates LXIV–LXXXIII, 31 Text Figures, and 3 Maps.

Dr. G. A. Boulenger's recently completed Fresh-water Fishes of Africa[2] has been used as a basis for the systematic part of this paper.

The four color-plates (Plates LXXX–LXXXIII) of thirteen species of fishes are successful reproductions from water-color sketches due to the artistic skill of Mr. J. P. Chapin. Painted in the field from living, freshly-captured specimens, their great value consists in their accuracy. In most cases the changes of color in dead fish are so rapid and so radical that often there is not even an indication left of their original beauty. After a long immersion in the preserving fluid some appear completely bleached. To give an idea of some of the difficulties an artist has to contend with, we might point out that in the forest regions the moisture was sometimes so great that during the process of painting these sketches had to be held over the fire, to dry one shade after the other so that the different colors would not flow together. It is interesting to note that they are the first records of this kind for fishes from the Congo basin. We regret that our limited funds would not allow the publication of 15 other equally interesting aquarelles.

The forty-one half-tones on Plates LXIV–LXXIX show the most interesting subjects of a collection of more than one hundred field photographs from freshly-killed specimens made by H. Lang, who has also contributed most of the color and field notes.

Thanks to the generosity of the Museum authorities, we are fortunate in being able to represent all of the new species in this collection by pen and ink drawings. Those of *Labeo sorex* and *Paratilapia xenodon* were made by Miss Ruth J. Powell, the one of *Labeo cyclopinnis* by Mr. Gerald H. Thayer, the remainder by Mr. Douglas B. Whitney. The black line under each text figure represents an inch length as measured on the specimen.

Only the strictly fresh-water fishes of the collection are included in this paper. They belong to the following families: Polypteridæ, Lepidosirenidæ,

---

[1] Scientific Results of the American Museum of Natural History Congo Expedition. Ichthyology, No. 1.

[2] George Albert Boulenger, F. R. S. Catalogue of the Fresh-water Fishes of Africa in the British Museum (Natural History), Vol. I to IV, 1909–1916.

Mormyridæ, Notopteridæ, Pantodontidæ, Clupeidæ, Characinidæ, Cyprinidæ, Siluridæ, Cyprinodontidæ, Serranidæ, Cichlidæ, Anabantidæ, Ophiocephalidæ, Mastacembelidæ and Tetrodontidæ.

Messrs. Lang and Chapin entered the Congo basin in June, 1909 and left September, 1915. During this period they traversed the Belgian Congo in its entire width from west to northeast. They also spent a few months in the adjoining Egyptian Sudan where they repeatedly had the opportunity of observing the close relations of the Congo and Nile systems.

Everywhere Belgian officials generously accorded them invaluable assistance. After establishing themselves in the different localities they naturally became acquainted with many of the native chiefs whose good will was also enlisted with satisfactory results.

The entire collection, consisting of close to 6000 fishes, includes 234 fresh-water forms, gathered in 23 localities (pp. 656–662). Among them were 4 genera and 29 species (pp. 654–655) which are described here for the first time. Eighteen species, known previously only from other African rivers, were found to inhabit also the Congo system (p. 655).

Though a few fish were taken everywhere along their journeys the more important material was fortunately gathered in the northeastern section of the Congo basin which was ichthyologically the most interesting part visited.

The collectors wish to express their deep gratitude for the kind encouragement accorded in this work; first, to Professor Henry Fairfield Osborn, President of the American Museum, under whose inspiring influence the widespread activities of the Congo Expedition could be carried to such satisfactory conclusion; secondly, to Professor Bashford Dean, to whom they are under great obligation for his practical and material aid. His continued interest in the ichthyological field-work contributed greatly to make the final results so successful.

1. *List of New Genera, and twenty-nine New Species with their Type Localities.*

NEW GENERA.

1. Microstomatichthyoborus.
2. Gnathobagrus.
3. Amarginops.
4. Acanthocleithron.

NEW SPECIES.

1. Marcusenius osborni. Upper Congo.
2. " retrodorsalis. Niapu.
3. Pellonula tenuis. Stanleyville.
4. Alestes carmesinus. Zambi.
5. Microstomatichthyoborus bashforddeani. Poko.
6. Distichodus langi. Faradje.

7. Labeo cyclopinnis. Stanleyville.
8. Labeo sorex. Stanleyville.
9. “ intermedius. Stanleyville.
10. Discognathus ornatus. Stanleyville.
11. Barbus atromaculatus. Yakuluku.
12. “ rubripinnis. Poko.
13. “ dolichosoma. Avakubi.
14. “ candens. Stanleyville.
15. Barilius salmolucius. Stanleyville.
16. Engraulicypris congicus. Poko.
17. Clarias zygouron. Malela.
18. “ malaris. Stanleyville.
19. Eutropius gastratus. Rungu.
20. Gnathobagrus depressus. Boma.
21. Amarginops platus. Stanleyville.
22. Amphilius notatus. Faradje.
23. Synodontis tenuis. Stanleyville.
24. Acanthocleithron chapini. Avakubi.
25. Doumea alula. Stanleyville.
26. Haplochilus platysternus. Stanleyville.
27. Paratilapia longipinnis. Coquilhatville.
28. “ xenodon. Rungu.
29. Lamprologus obliquus. Stanleyville.

2. Validity of the following Genera and Species is questioned.

Genera.	*Referred to under:*
Microthrissa	Pellonula congica
Pœcilothrissa	“ “
Potamothrissa	“ “
Cynothrissa	“ “
Micralestes	Alestes liebrechtsii
Petersius	“ “
Species	*Referred to under:*
Bryconæthiops yseuxii	Bryconæthiops microstoma
Labeo velifer	Labeo longipinnis
Barbus pleuropholis	q. v.
Haplochromis moffati	Haplochromis desfontainesii
Tilapia stigmatogenys	Tilapia williamsii
Nannochromis squamiceps	q. v.

3. The following Species are recorded for the first time from the Congo Drainage.

Mormyrops breviceps
Gnathonemus livingstonii
Petersius occidentalis
Labeo coubie
“ kirkii
“ forskalii
“ parvulus
“ chariensis
“ ogunensis

Labeo ansorgii
Discognathus dembeensis
Barbus musumbi
Clarias breviceps
Chrysichthys acutirostris
Arius africanus
Synodontis afro-fischeri
Tilapia acuticeps
Haplochromis strigigena

4. List of Localities, with names of the Species and Subspecies taken at each.

Avakubi.

Polypterus ornatipinnis
Mormyrops deliciosus
“ sirenoides
“ attenuatus
Petrocephalus sauvagii
“ simus
Marcusenius nigripinnis
“ tumifrons
“ plagiostoma
“ psittacus
Myomyrus macrops
Gnathonemus monteiri
“ greshoffi
“ mirus
“ elephas
“ rhynchophorus
“ ibis
Mormyrus bumbanus
“ ovis
“ caballus
Pellonula tenuis
“ congica
“ royauxi
Sarcodaces odoë
Bryconæthiops microstoma
Alestes liebrechtsii
“ imberi
“ grandisquamis
Micralestes acutidens
“ stormsi
“ altus
Petersius caudalis
“ woosnami
“ occidentalis
Eugnathichthys eetveldii
“ macroterolepis
Distichodus affinis
“ maculatus
“ fasciolatus
“ sexfasciatus
“ lusosso
Nannocharax fasciatus
“ elongatus
Citharinus gibbosus
Labeo weeksii
Labeo greenii
Labeo parvulus
“ annectens
“ chariensis
“ parvus
“ ogunensis
Discognathus dembeensis
Barbus caudovittatus
“ holotænia
“ pleuropholis
“ dolichosoma
Barilius weynsii
“ ubangensis
“ salmolucius
Engraulicypris congicus
Chelæthiops elongatus
Clarias angolensis
“ bythipogon
Eutropius niloticus
“ grenfelli
“ debauwi
Schilbe congolensis
Bagrus ubangensis
Chrysichthys wagenaari
“ punctatus
“ delhezi
Gephyroglanis longipinnis
Auchenoglanis occidentalis
“ ballayi
Synodontis acanthomias
“ depauwi
“ greshoffi
“ pleurops
“ decorus
Euchilichthys guentheri
“ dybowskii
Acanthocleithron chapini
Doumea alula
Malopterurus electricus
Tilapia christyi
Haplochromis desfontainesii
Pelmatochromis lateralis
Hemichromis fasciatus
Lamprologus obliquus
Anabas nanus
Mastacembelus congicus

Bafwabaka.

Marcusenius nigripinnis
Barbus holotænia
“ atromaculatus
Auchenoglanis ballayi
Synodontis depauwi
Malopterurus electricus
Anabas nanus

Banana.

Protopterus dolloi

Basoko.

Pantodon buchholzi
Anabas nanus

Bolobo.

Alestes macrolepidotus

Boma.

Odaxothrissa ansorgii
Distichodus affinis
Eutropius congolensis
“ liberiensis
Chrysichthys acutirostris
Chrysichthys furcatus
“ cranchii
Gnathobagrus depressus
Auchenoglanis occidentalis

Coquilhatville.

Polypterus palmas
Marcusenius plagiostoma
“ wilverthi
Xenomystus nigri
Bryconæthiops microstoma
Alestes bimaculatus
Petersius hilgendorfi
Mesoborus crocodilus
Schilbe mystus
Synodontis alberti
“ notatus
Tilapia melanopleura
Hemichromis fasciatus
Anabas nigropannosus
Ophiocephalus obscurus

Faradje.

Polypterus congicus
“ ornatipinnis
“ palmas
Mormyrops deliciosus
“ breviceps
“ sirenoides
“ microstoma
“ attenuatus
Petrocephalus sauvagii
“ simus
Marcusenius nigripinnis
“ pulverulentus
“ plagiostoma
“ psittacus
“ wilverthi
Stomatorhinus microps
Myomyrus macrodon
“ macrops
Gnathonemus petersii
“ monteiri
“ stanleyanus
“ greshoffi
“ tamandua
“ mirus
“ elephas
“ rhynchophorus
“ ibis
“ curvirostris
Mormyrus bumbanus
“ ovis
“ caballus
Sarcodaces odoë
Hydrocyon lineatus
Bryconæthiops microstoma
Alestes macrophthalmus
“ liebrechtsii

Faradje.

Alestes imberi
“ schoutedeni
“ macrolepidotus
“ grandisquamis
Micralestes acutidens
Petersius woosnami
“ occidentalis
Eugnathichthys eetveldii
“ macroterolepis
Mesoborus crocodilus
Phago boulengeri
Distichodus affinis
“ maculatus
“ antonii
“ fasciolatus
“ langi
“ sexfasciatus
Distichodus lusosso
Nannocharax elongatus
“ tænia
Citharinus congicus
“ gibbosus
Labeo weeksii
“ longipinnis
“ macrostoma
“ falcipinnis
“ greenii
“ chariensis
“ parvus
Discognathus dembeensis
Barbus caudovittatus
“ holotænia
“ atromaculatus
Barilius kingsleyæ
Clarias submarginatus
Clarias angolensis
“ bythipogon
Eutropius congensis
“ niloticus
“ grenfelli
“ gastratus
Schilbe mystus
Bagrus ubangensis
Chrysichthys delhezi
Gephyroglanis longipinnis
Amphilius notatus
Auchenoglanis occidentalis
“ ballayi
Synodontis acanthomias
“ afro-fischeri
“ depauwi
“ greshoffi
“ pleurops
“ decorus
Chiloglanis batesii
Euchilichthys guentheri
“ royauxi
“ dybowskii
Doumea alula
Belonoglanis tenuis
Malopterurus electricus
Haplochilus elegans
Lates niloticus
Tilapia melanopleura
Pelmatochromis lateralis
Lamprologus obliquus
Anabas nanus
Ophiocephalus obscurus
Mastacembelus congicus
Tetrodon mbu

Garamba.

Alestes nurse
Mesoborus crocodilus
Labeo parvus
Barbus holotænia
Barilius kingsleyæ
Tilipia melanopleura
Lamprologus obliquus

Irebu.

Paratilapia longipinnis

Kwamouth.

Hydrocyon lineatus

Malela.

Eugnathichthys macroterolepis
Clarias zygouron
“ bythipogon
Channallabes apus
Chrysichthys ornatus
Tilapia lepidura
Ophiocephalus obscurus

Medje.

Barbus pleuropholis
Barilius ubangensis
Clarias angolensis
Haplochilus elegans
Anabas nanus

Niangara.

Genyomyrus donnyi
Barbus fasolt
“ holotænia
Barilius salmolucius
Clarias angolensis
Schilbe congolensis
Phractura scaphirhynchura
Hemichromis fasciatus
Anabas nanus
Tetrodon mbu

Niapu.

Petrocephalus simus
Marcusenius nigripinnis
“ osborni
“ retrodorsalis
Myomyrus macrodon
Gnathonemus moorii
“ petersii
Micralestes altus
Petersius woosnami
Phago boulengeri
Nannæthiops tritæniatus
Nannocharax tænia
Barbus holotænia
“ pleuropholis
Barilius ubangensis
Clarias platycephalus
“ bythipogon
Channallabes apus
Eutropius grenfelli
“ debauwi
Schilbe congolensis
Chrysichthys ornatus
Auchenoglanis ballayi
Microsynodontis batesii
Phractura scaphirhynchura
Belonoglanis tenuis
Hemichromis fasciatus
Anabas nanus
Mastacembelus congicus

Nouvelle Anvers.

Protopterus dolloi
Anabas nigropannosus

Panga.

Euchilichthys guentheri

Poko.

Mormyrops sirenoides
“ attenuatus
Petrocephalus sauvagii
“ simus
Marcusenius nigripinnis
Gnathonemus petersii
“ monteiri
“ stanleyanus
“ greshoffi
Gnathonemus mirus
“ elephas
“ rhynchophorus
“ ibis
Pellonula congica
“ royauxi
Sarcodaces odoë
Bryconæthiops microstoma
Alestes macrophthalmus

Poko.

Alestes longipinnis
“ imberi
“ macrolepidotus
“ grandisquamis
Micralestes acutidens
“ altus
Petersius occidentalis
Eugnathichthys eetveldii
“ macroterolepis
Mesoborus crocodilus
Phago intermedius
Microstomatichthyoborus bashforddeani
Distichodus affinis
“ maculatus
“ fasciolatus
“ lusosso
Nannocharax elongatus
“ tænia

Barbus rubripinnis
Barilius salmolucius
Engraulicypris congicus
Clarias bythipogon
Channallabes apus
Eutropius debauwi
Schilbe congolensis
Ansorgia vittata
Chrysichthys wagenaari
“ delhezi
“ thonneri
Synodontis pleurops
“ decorus
Euchilichthys dybowskii
Tilapia melanopleura
Paratilapia macrocephala
Hemichromis fasciatus
Tetrodon mbu

Rungu.

Mormyrops deliciosus
“ sirenoides
“ attenuatus
Petrocephalus sauvagii
Marcusenius psittacus
“ wilverthi
Gnathonemus petersii
“ monteiri
“ stanleyanus
“ rhynchophorus
Sarcodaces odoë
Hydrocyon lineatus
Bryconæthiops microstoma
Alestes liebrechtsii
“ imberi
“ schoutedeni
“ grandisquamis
Micralestes altus
Petersius woosnami
Eugnathichthys eetveldii
“ macroterolepis
Mesoborus crocodilus
Distichodus affinis
“ maculatus
“ fasciolatus
“ sexfasciatus
“ lusosso

Labeo longipinnis
“ macrostoma
“ intermedius
“ parvus
Barbus musumbi
Barilius weynsii
Clarias bythipogon
Channallabes apus
Eutropius grenfelli
“ gastratus
Schilbe congolensis
Chrysichthys ornatus
“ thonneri
Auchenoglanis ballayi
Synodontis acanthomias
“ afro-fischeri
“ depauwi
“ greshoffi
“ pleurops
Tilapia melanopleura
Paratilapia xenodon
Pelmatochromis lateralis
Hemichromis fasciatus
Ophiocephalus obscurus
Mastacembelus congicus
Tetrodon mbu

Stanleyville.

Polypterus congicus
“ ornatipinnis
“ palmas
Mormyrops deliciosus
“ attenuatus
Petrocephalus sauvagii
“ ballayi
“ simus
Marcusenius nigripinnis
“ tumifrons
“ plagiostoma
“ psittacus
“ wilverthi
Stomatorhinus humilior
“ microps
Myomyrus macrodon
Gnathonemus monteiri
“ stanleyanus
“ cyprinoides
“ greshoffi
“ tamandua
“ mirus
“ elephas
“ rhynchophorus
“ ibis
“ curvirostris
“ numenius
Mormyrus bumbanus
“ ovis
“ caballus
“ rume
“ proboscirostris
Pellonula acutirostris
“ tenuis
“ congica
“ royauxi
Odaxothrissa losera
Sarcodaces odoë
Hydrocyon lineatus
“ goliath
Bryconæthiops microstoma
Alestes macrophthalmus
“ liebrechtsii
“ imberi
“ macrolepidotus
Petersius woosnami
“ occidentalis
Eugnathichthys eetveldii
“ macroterolepis
Distichodus maculatus
“ antonii
“ atroventralis
“ fasciolatus
“ sexfasciatus
“ lusosso
Nannocharax brevis
Citharinus congicus
“ gibbosus
Labeo weeksii
“ lineatus
“ longipinnis
“ coubie
“ macrostoma
“ cyclopinnis
“ sorex
“ falcipinnis
“ kirkii
“ forskalii
“ nasus
“ greenii
“ annectens
“ chariensis
“ intermedius
“ parvus
“ ansorgii
Discognathus ornatus
Barbus fasolt
“ holotænia
Barbus atromaculatus
“ pleuropholis
“ candens
Leptocypris modestus
Barilius lujæ
“ weynsii
“ salmolucius
Chelæthiops elongatus
Clarias platycephalus
“ malaris
“ breviceps
“ angolensis
“ bythipogon
Channallabes apus
Heterobranchus longifilis
Eutropius congensis

Stanleyville.

Eutropius niloticus
“ grenfelli
“ gastratus
Schilbe mystus
Parailia longifilis
Bagrus ubangensis
Chrysichthys brevibarbis
“ longibarbis
“ duttoni
“ cranchii
“ punctatus
“ delhezi
“ ornatus
“ thonneri
Amarginops platus
Gephyroglanis congicus
“ longipinnis
Auchenoglanis occidentalis
“ ballayi
Arius africanus
Synodontis acanthomias
“ afro-fischeri
“ depauwi
“ angelicus
“ soloni
“ longirostris
“ tenuis
“ greshoffi
“ alberti
“ notatus
“ pleurops
Synodontis decorus
Euchilichthys guentheri
“ royauxi
“ dybowskii
Doumea alula
Paraphractura tenuicauda
Belonoglanis tenuis
Malopterurus electricus
Haplochilus platysternus
“ elegans
“ multifasciatus
“ singa
Lates niloticus
Tilapia boulengeri
“ dolloi
“ melanopleura
“ acuticeps
“ williamsii
“ stormsii
Steatocranis gibbiceps
Haplochromis strigigena
“ desfontainesii
Nannochromis squamiceps
Pelmatochromis lateralis
Hemichromis fasciatus
Lamprologus obliquus
Anabas nanus
Ophiocephalus obscurus
Mastacembelus congicus
Tetrodon mbu
“ miurus

Vankerckhovenville.

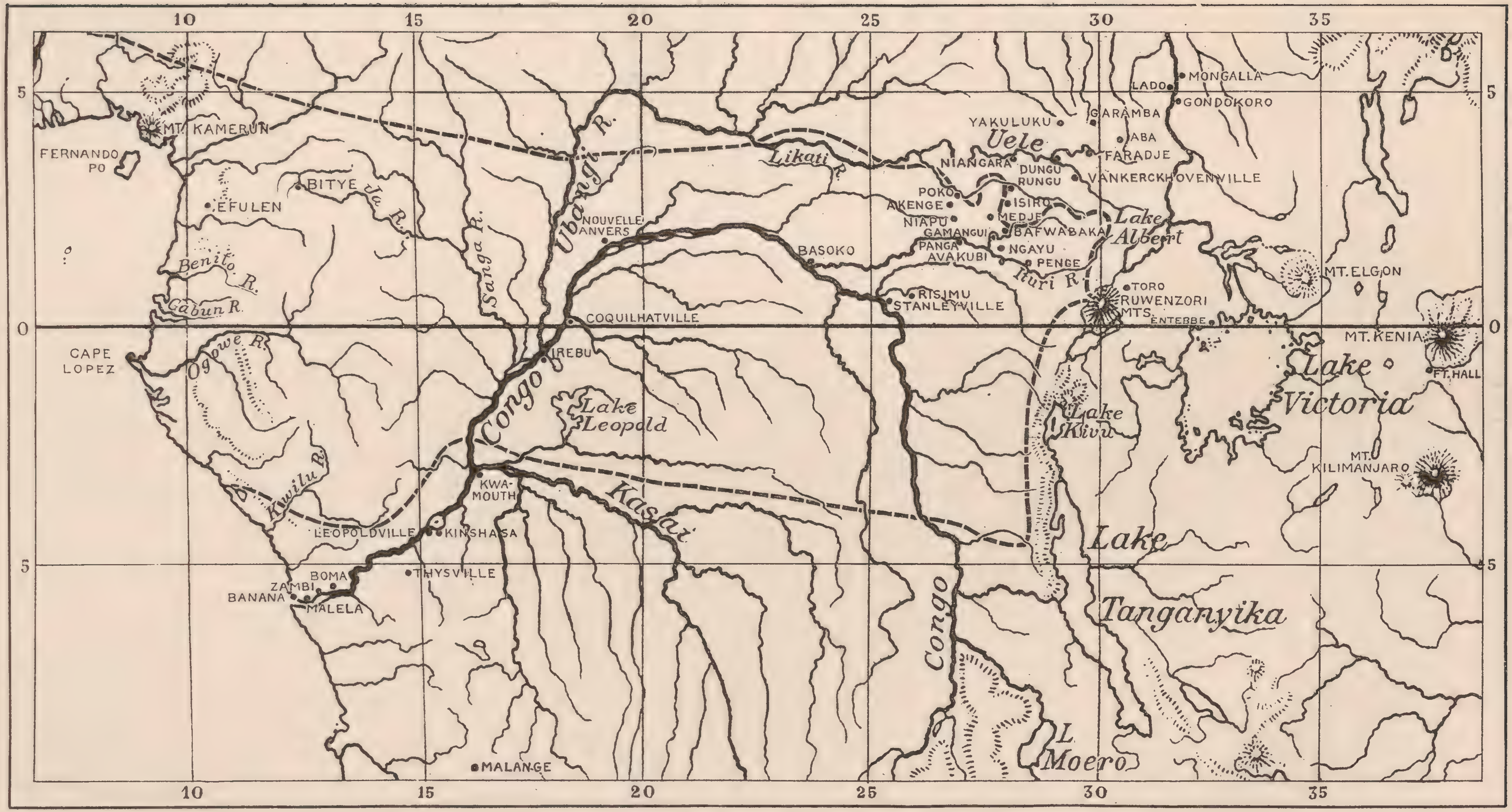
Gnathonemus petersii
Anabas nanus
Ophiocephalus obscurus

Yakuluku.

Bryconæthiops microstoma
Micralestes stormsi
Barbus atromaculatus
“ pleuropholis

Zambi.

Polypterus palmas
Gnathonemus leopoldianus
“ livingstonii
Xenomystus nigri
Sarcodaces odoë
Alestes grandisquamis
“ carmesinus
Clarias bythipogon
Channallabes apus
Schilbe mystus
Chrysichthys cranchii
Haplochilus spilauchen
Tilapia lepidura
“ fasciata
Hemichromis fasciatus
“ bimaculatus
Anabas nigropannosus
“ congicus
Ophiocephalus obscurus



Map 1. Congo and Lake Region of Africa, showing all the localities where fishes were collected by the Congo Expedition, as well as some others mentioned in the present paper. The limits of the West African rain forest are indicated by a broken line.

POLYPTERIDÆ.

1. **Polypterus congicus** *Boulenger.*

About a dozen specimens, ranging from 8 to 26 inches in length, from Stanleyville and Faradje.

2. **Polypterus ornatipinnis** *Boulenger.*

Plate LXXXIII, Fig. 3 (colored).

Most of the *Polypterus* material belongs to this species. There are about 180 specimens, ranging in length from 2 inches to 2 feet, from Avakubi, Faradje and Stanleyville. The alleged differences between *weeksi* and *ornatipinnis* do not hold in this material. In those examined the dorsal spines are IX or X, scales 58 to 61, 38 to 44 around middle of body. The eye is $\frac{1}{3}$ to $\frac{1}{2}$ the interorbital. In marking and appearance most of the specimens resemble Boulenger's figure of *ornatipinnis,* in fact there is no specimen which resembles the figure of the type of *weeksi.* Otherwise we should consider *ornatipinnis* a synonym of it.

Concerning this species Mr. Lang says: "Despite its heavy scales this fish is very pliant and can twist like an eel, swimming in a similar manner. We have never seen the pectoral fins held like those of *Periophthalmus,* as they have so often been figured. When in use, both in and out of the water, the anterior paired fins are often spread horizontally, otherwise they lie against the side in the normal position. The two nasal tubes point forward and are often moved from side to side. An adult can be out of water at least two or three hours without detriment. In life the whole fish is covered with a slimy gelatinous coating obscuring the scales of the body and the plates of the head. When handled the series of dorsal spines, ordinarily depressed, is suddenly set erect with an accompanying backward jerk of the body and may seriously lacerate the hand of the captor. This species is often found in swamps, in inundated areas, up small brooks and about rocks in the main river. The very young are usually taken near grassy swamps where they swim about singly, their external gills continually in motion.

"The natives cook *Polypterus* in the hot ashes much as they do potatoes. When the fish is cooked the scales separate from the beautiful white meat. As regards flavor it is the best food fish in the Congo. The meat, though small in quantity, is firm, without any muddy taste, but has many bones. The smaller bones are eaten with the meat by the natives."

The following field notes accompany a color sketch by Mr. Chapin, of a Faradje specimen which is reproduced in this paper: "There seems to be but one species here, for all are alike in color, though the number of dorsal spines varies slightly. When fresh they are somewhat shiny but soon change in drying to dull gray."

3. **Polypterus palmas** *Ayres.*

Twenty-one specimens from 3 inches up to a foot in length,— 2 from Faradje, 2 from Stanleyville, 1 from Coquilhatville, 15 from Zambi. From these figures we judge it the most abundant species in the lower river. "It is taken in numbers at Zambi with the seine in grassy swamps bordering the Congo."

LEPIDOSIRENIDÆ.

4. **Protopterus dolloi** *Boulenger.*

Only 4 specimens, three 2 or 3 feet in length from near Nouvelle Anvers, and 1 of about 9 inches from a papyrus swamp near Banana.

"At Nouvelle Anvers the natives bring *Protopterus* to market from nearby swamps, usually four or five fish alive in a pot with very little water. They are much afraid of being bitten by them. When one is thrown on the ground it is very active, wriggling like a snake, and progressing in like manner.

"The small one from Banana was taken at the end of the dry season and here it was said by natives that only those living in swamps which dried out completely are found buried in the dry mud, most of them remained active throughout the year. They brought in two others, but from fear of handling them these had been cut up with knives and were not kept as specimens.

"None were seen on the Uele or Ituri though natives spoke of their presence and described their habit of estivating."

MORMYRIDÆ.

5. **Mormyrops deliciosus** (*Leach*).

Plate LXIV, Fig. 1.

Numerous specimens from Stanleyville, Faradje, Rungu and Avakubi, from 2 inches up to over 2 feet in length. Specimens 4 inches or less in length from Avakubi, August and October; Faradje, December; Stanleyville, February and April.

Mr. Chapin made a color sketch of a 10 inch specimen from Avakubi caught on a hook at night. Most of the head, the back and area at base of anal in this sketch are greenish yellow; otherwise the fish is pale purplish gray with a few faint irregular dusky scrawls on the side, the vertical fins dusky. Mr. Chapin's notes say that it is the slime that is yellow, and that there is no metallic luster save in the iris.

"Common in the long muddy stretches of the river. Probably does not occur in schools as only two or three would be killed by a single explosion of tonite. Though prized for food, the meat is musky and of not very good flavor.

"The young of various Mormyrids are very abundant in swamps at the edge of the rivers. Natives catch them in large quantities and use them for food, after boiling them whole and pounding them in mortars. They are rare in rocky or swift water, and apparently do not occur in the extreme head waters.

"All the Mormyrids are covered with a persistent gelatinous slimy skin which usually has a yellowish or purplish tint. When they are placed in formalin this skin separates and flakes off in shreds of about one mm. thickness.

"Mormyrids die more quickly than other Congo fishes out of water, or in tanks."

6. **Mormyrops breviceps** *Steindachner.*

A single fish 20 inches long from Faradje in February. We have compared it carefully with the type description and figure of Steindachner's Liberian fish, and although there are some differences, these seem to us within the range of individual variation. The head is longer ($4\frac{3}{4}$), interorbital broader ($6\frac{1}{4}$), ventral shorter ($3\frac{1}{3}$), more teeth ($\frac{26}{26}$).

7. **Mormyrops masuianus** *Boulenger.*

Five specimens, about 3 inches in length, from the Upper Congo (one of these from Bafwabaka). One specimen of 10 inches which we place here has the depth 7, as in *sirenoides*.

8. **Mormyrops sirenoides** *Boulenger.*

Several specimens from 5 to 20 inches in length from Avakubi, Faradje, Poko and Rungu.

9. **Mormyrops microstoma** *Boulenger.*

One specimen only, from Faradje.

10. **Mormyrops attenuatus** *Boulenger.*

Several specimens, 3 inches to over a foot in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. Five specimens, 4 to 7 inches long, from Faradje were dark purplish in color.

11. **Petrocephalus sauvagii** (*Boulenger*).

Several specimens from 2 to 6 inches in length from Avakubi, Faradje, Poko, Rungu and Stanleyville.

"Fishes of the genus *Petrocephalus* doubtless swim in schools as many are often taken at one time. They are found in deeper, more open water than *Mormyrops* and are less addicted to mud."

12. **Petrocephalus ballayi** *Sauvage.*

Twelve small specimens, 1 or 2 inches in length, from Stanleyville, April, from an affluent of the Tshopo River, "a clear, running forest brook, where they were numerous in a shaded pool under a tree. There were some small Labeos in the same place."

13. **Petrocephalus simus** *Sauvage.*

Plate LXXXII, Fig. 1 (colored).

Several specimens, 2 to 10 inches in length, from Avakubi, Faradje, Niapu, Poko and Stanleyville.

14. **Marcusenius nigripinnis** *Boulenger.*

Several specimens, one half inch to 3 inches in length, from Avakubi, Bafwabaka, Faradje, Niapu, Poko and Stanleyville.

15. **Marcusenius pulverulentus** *Boulenger.*

Four specimens 3 to 5 inches in length from Faradje.

16. **Marcusenius osborni** sp. nov.

Anal originating well in advance of dorsal. Teeth $\frac{5}{8}$. 14 scales around caudal peduncle. Depth $2\frac{4}{5}$. Dorsal 16. Snout deep and projecting. Mouth very small, its breadth about equal to diameter of eye.

The type, No. 6934, American Museum of Natural History, from the Uele River, but without specific data, is 57 mm. long to base of caudal. Depth $2\frac{4}{5}$ times in this measure. Body strongly compressed, the head less so, high and convex between the eyes. Snout deep, rounded, suggesting *Petrocephalus.* Head $3\frac{1}{3}$ in length. Eye equal to breadth of mouth and a little shorter than snout, its diameter contained 5 times in the length of head. Teeth feebly notched, $\frac{5}{8}$. Dorsal 16, originating over 10th ray of anal. Anal 24, equidistant from root of ventral and of caudal. Caudal forked, its peduncle 3 times as long as deep. Fifty-eight scales in lateral line, about 14/14 in transverse series on body, 14 around peduncle. Dark purplish brown, paler greenish on the head and nape.

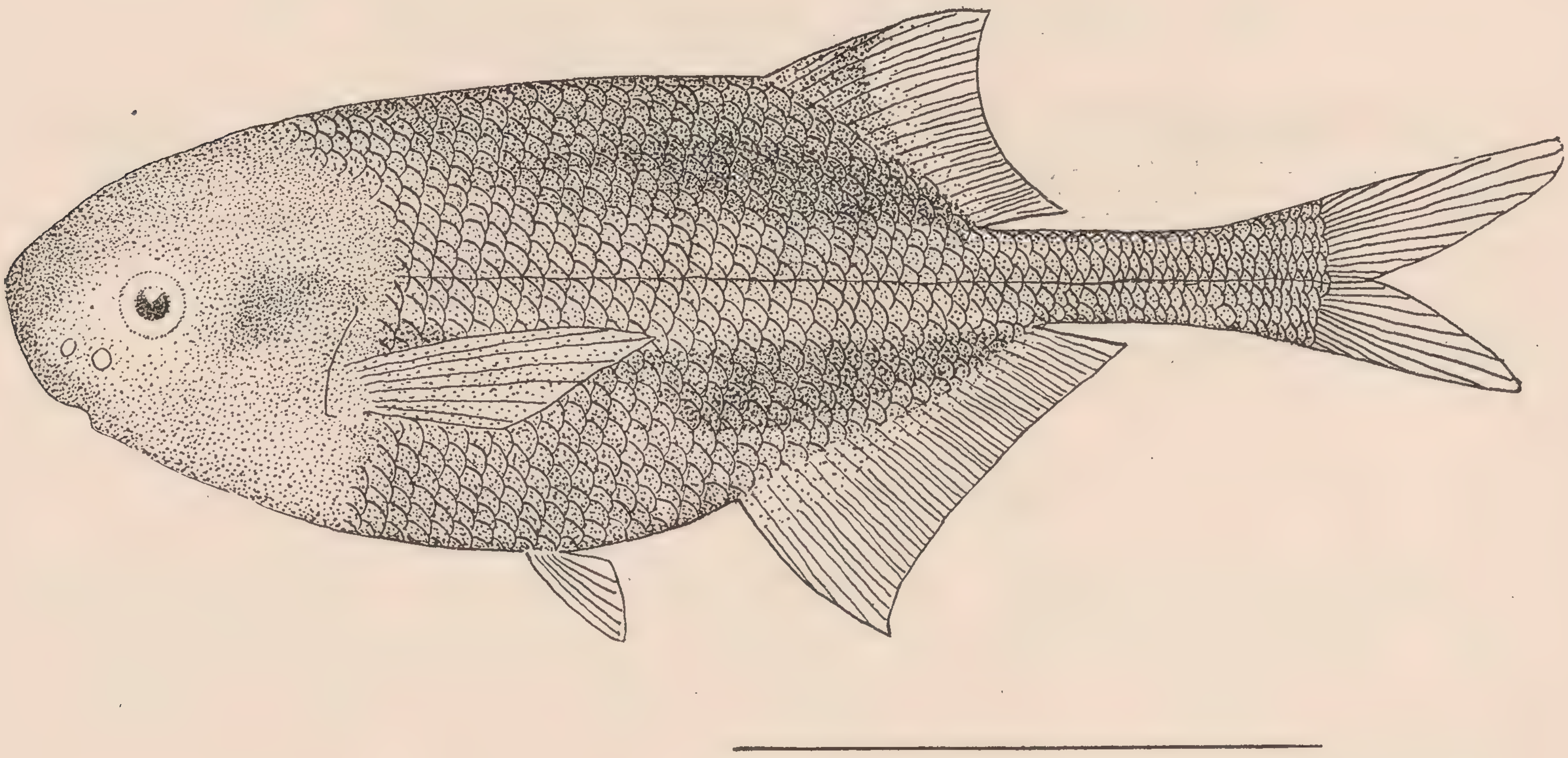


Fig. 1. *Marcusenius osborni,* type.

Besides the type there are two smaller specimens about an inch in length from Niapu.

An ordinary looking species, but rather well differentiated by its technical characters, comparable with *lhuysii* and *adspersus* on the one hand, *nigricans* and *isidori* on the other.

Named for Professor Henry Fairfield Osborn, President of the American Museum of Natural History to whose continuous and inspiring support is due in a large measure the great success of the Congo Expedition.

17. **Marcusenius retrodorsalis** sp. nov.

Close to *M. sphecodes,* but eye smaller, 4 times in interorbital; dorsal and anal placed much further back, so that dorsal origin is equidistant from tip of pectoral and base of caudal; caudal peduncle $2\frac{1}{2}$ times as long as deep; teeth $\frac{7}{8}$.

The type, our only specimen, No. 6933, American Museum of Natural History, Niapu, Congo, Nov. 1913, from a small forest brook tributary to the Bima River, measures 114 mm. in length to base of caudal; depth of body equal to length of head, 5 times in this measure. Head slightly longer than deep; snout rounded, $3\frac{3}{4}$ times length of head; mouth small, subinferior, its width $\frac{1}{5}$ length of head; teeth small, notched, 7 in upper jaw, 8 in lower; nostrils midway between eye and end of snout, the posterior on a line with lower border of eye; eye very small, $\frac{1}{3}$ length of snout, $\frac{1}{4}$ interorbital width. Dorsal 17, originating above 5th ray of anal, not $\frac{1}{3}$ as long as its distance from head, its origin equidistant from tip of pectoral and root of caudal. Anal 24, much nearer root of caudal than base of ventral, about $1\frac{1}{3}$ as long as dorsal. Pectoral pointed, $\frac{3}{4}$ length of head, $1\frac{1}{2}$ length of ventral, not reaching base of latter. Caudal with pointed lobes. Caudal peduncle $2\frac{1}{2}$ times as long as deep. 67 scales in lateral line, 12 around caudal peduncle. Uniform brownish.

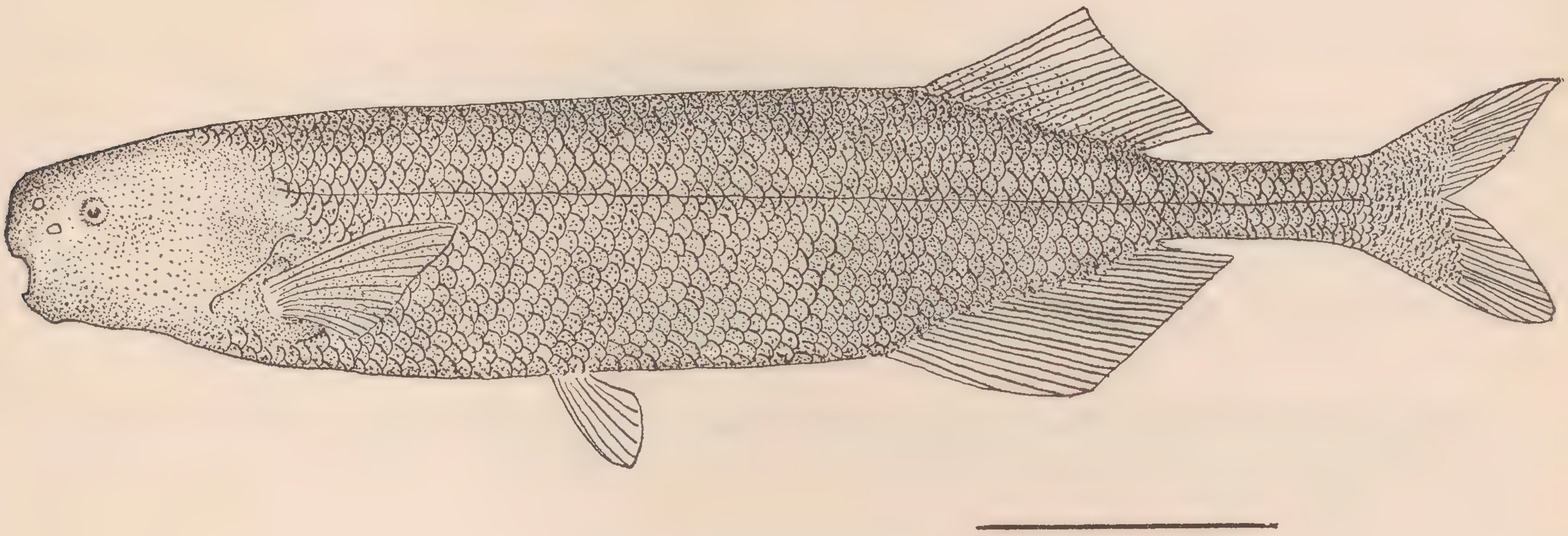


Fig. 2. *Marcusenius retrodorsalis*, type.

18. **Marcusenius tumifrons** *Boulenger.*

Several specimens, 2 to 6 inches in length, from Stanleyville and Avakubi.

19. **Marcusenius plagiostoma** *Boulenger.*

Several specimens, 1 to 6 inches in length, from Avakubi, Faradje, Stanleyville and Coquilhatville.

20. **Marcusenius psittacus** (*Boulenger*).

Plate LXIV, Fig. 2.

Numerous specimens, from 4 inches to over a foot in length, from Avakubi, Faradje, Rungu and Stanleyville; about $\frac{5}{6}$ of the total number are from Stanleyville.

"Taken in large numbers in rather deep, muddy water."

21. **Marcusenius wilverthi** *Boulenger.*

About half a dozen specimens, 6 inches to a foot long, from Faradje, Rungu, Stanleyville and Coquilhatville.

22. **Stomatorhinus humilior** *Boulenger.*

Four specimens, 3 or 4 inches long, from Stanleyville.

23. **Stomatorhinus microps** *Boulenger.*

Several specimens, one half an inch to 5 inches in length, from Faradje and Stanleyville.

24. **Myomyrus macrodon** *Boulenger.*

Several specimens, 1 inch to over a foot in length, from Faradje, Niapu and Stanleyville.

25. **Myomyrus macrops** *Boulenger.*

Plate LXIV, Fig. 3.

Several specimens, 2 to 9 inches long, from Avakubi, Faradje and the lower Congo. One 7 or 8 inches long from Faradje was grayish with a paler snout.

26. **Gnathonemus moorii** (*Günther*).

Four small specimens, 3 or 4 inches long, from Niapu and the Upper Congo.

27. **Gnathonemus petersii** (*Günther*).

Plate LXV, Fig. 2.

Several specimens, 4 inches to a foot in length, from Faradje, Niapu, Rungu, Poko and Vankerckhovenville.

"The mental appendage is not moved voluntarily, but is very flexible when struck against floating algæ, apparently with the purpose of detaching minute organisms which may then be sucked into the fish's small mouth."

28. **Gnathonemus leopoldianus** *Boulenger.*

One specimen, only 5 inches long, from Zambi, taken with *Polypterus* in grassy swamps at the edge of the river.

29. **Gnathonemus livingstonii** *Boulenger.*

Five specimens, about 5 inches long, from Zambi, taken with *Polypterus* in grassy swamps at the edge of the river. We have placed them with this East African species after due deliberation. They agree with it admirably.

30. **Gnathonemus monteiri** (*Günther*).

Plate LXV, Fig. 1.

One of the commonest members of the genus. Numerous specimens, 3 inches to over a foot in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. A very beautifully colored fish. One of the larger ones from Faradje, had the back and crown dark grayish green, changing to bronzy with blue reflections on the upper part of the sides, and to silvery with blue reflections on the lower part of same, the cheeks dotted with gray and with some golden on their lower part; iris silvery freckled with dark gray; caudal somewhat pinkish. Another over a foot in length from Rungu was silvery brownish green with golden reflections on the back. Mr. Chapin made a field sketch of an 11-inch specimen from Avakubi, which was silvery on the sides, yellow green along the back and top of the head; the upper part of the peduncle and most of the caudal lobes black. His notes say: "Caught on a hook. The yellow color of the back is of course in the slime. After the fish lay for some time exposed to the light, the skin of the throat, sides of head and belly became covered with tiny dusky spots."

31. **Gnathonemus stanleyanus** (*Boulenger*).

Several specimens, from 3 inches to over a foot in length, from Faradje, Poko, Rungu and Stanleyville. A specimen from Rungu was gray-green on the back with golden reflections, sides silvery with bluish reflections, silvery white below; another about 5 inches long had the general color silvery brownish green with golden reflections on the back.

32. **Gnathonemus cyprinoides** (*Linnæus*).

Five specimens, 2 to 7 inches in length, from Stanleyville.

33. **Gnathonemus greshoffi** (*Schilthuis*).

Several specimens, 3 to 6 inches in length, from Avakubi, Faradje, Poko and Stanleyville.

34. **Gnathonemus tamandua** (*Günther*).

Plate LXV, Fig. 3.

Several specimens, from an inch and a half to a foot in length, from Faradje and Stanleyville. One 6 inches long from Faradje was dark greenish with iris bronzy in color.

35. **Gnathonemus mirus** *Boulenger*.

Plate LXXXII, Fig. 1 (colored).

Several specimens, from 6 inches to almost 2 feet in length, from Avakubi, Faradje, Poko and Stanleyville. One from Faradje, according to Mr. Lang, was dark green above, lighter towards the snout, silvery gray on the sides, pinkish near the gill-covers. Fins grayish-green suffused with pinkish, tipped with yellowish. The opening of the mouth pinkish.

36. **Gnathonemus elephas** *Boulenger*.

Numerous specimens, from 1 inch to almost 2 feet in length, from Avakubi, Faradje, Poko and Stanleyville. Quite a number were killed with poison in the stony sections of the Dungu River at Faradje. Eaten extensively by white men.

37. **Gnathonemus rhynchophorus** *Boulenger*.

Plate LXV, Fig. 4.

Several specimens, 3 inches to a foot and a half in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. A large one from Avakubi had the color dusky brownish, greenish below, iris silvery; another large one from Faradje was purplish blue above, with yellowish slime at certain places, purplish gray below. Others also from Faradje were purplish gray all over except for whitish areas on belly, and yellowish slime on head. One from Rungu was dark purplish in color. Mr. Chapin made a color sketch of one of about 10 inches from Avakubi, caught on a hook in the evening. The sides are ash gray, clouded with extensive areas of dark blue slate. The head, back and area at base of anal are dark olive green, vertical fins dusky olive. His notes say: "The greenish color of the back, etc., is as usual due to slime. No metallic reflections save in iris."

38. **Gnathonemus ibis** *Boulenger.*

Several specimens, from 6 inches to 2 feet in length, from Avakubi, Faradje, Poko and Stanleyville. One somewhat less than a foot long from Faradje was dark purple blue, nearly black, with a green tinge. The proportions of the snout are variable (generally longer and more slender in large specimens) and it is difficult to draw the line between *rhynchophorus* and *ibis*, which are at best closely related.

39. **Gnathonemus curvirostris** *Boulenger.*

Three specimens, a foot and a half to 2 feet in length, from Faradje and Stanleyville.

40. **Gnathonemus numenius** *Boulenger.*

Two specimens, 20 inches in length, from Stanleyville. The least depth of the snout is only 17 in its length instead of 20 as it should be according to Boulenger; the angle and general contour thereof however resemble *numenius*, with which species we have no hesitation in placing our specimens.

41. **Genyomyrus donnyi** *Boulenger.*

One, 18 inches long, from Niangara, taken with poison in a rocky stretch of river.

42. **Mormyrus bumbanus** *Boulenger.*

Several specimens, 2½ inches to about a foot in length, from Avakubi, Faradje and Stanleyville.

43. **Mormyrus ovis** *Boulenger.*

Several specimens, 6 inches to a foot and a little over in length, from Avakubi, Faradje and Stanleyville.

44. **Mormyrus caballus** *Boulenger.*

Plate LXIV, Fig. 4.

Several specimens, 6 to 20 inches in length, from Avakubi, Faradje and Stanleyville. One about a foot and a half in length from Faradje had the following colors: Back dark greenish brown with golden reflections on sides. Mouth light gray. Ventral surface grayish white. Fins bluish gray.

"It doubtless swims in schools, as when taken with tonite a number would be killed at one explosion."

45. **Mormyrus rume** *Cuvier & Valenciennes.*

Two specimens, 9 to 18 inches long, from Stanleyville, taken in a rocky stretch of river.

46. **Mormyrus proboscirostris** *Boulenger.*

Four specimens, about 2 feet in length, from Stanleyville, taken in a rocky stretch of river.

NOTOPTERIDÆ.

47. **Xenomystus nigri** (*Günther*).

The specimens range from 3 to 8 inches in length. There are two from Coquilhatville and many from Zambi.

"Near Coquilhatville this species is abundant in the broad marshy expanses and frequently brought to market. At Zambi it was taken in grassy swamps at the edge of the river with *Polypterus* and Mormyrids."

PANTODONTIDÆ.

48. **Pantodon buchholzi** *Peters.*

A single specimen, 2 or 3 inches long, from Basoko.

"At Basoko, one of these remarkable fresh-water flying fish took a rather long skip over the water, startled by a native dugout that passed through the narrow lane between the shore and the steamer lying at her moorings. It looked peculiar, quite different from the smooth, silvery *Alestes*. Some species of this genus are often seen leaping in schools from the water as if to escape an enemy in hot pursuit. We were still wondering what fish this was when another *Pantodon* rose and, badly frightened by the rapidly moving boat, landed on the level shore. There it struggled like any other fish on the beach and all its efforts with its strong caudal and broad pectoral fins could not raise it into the air again. This was the only occasion we met with this species."

CLUPEIDÆ.

49. **Pellonula vorax** *Günther.*

Two specimens, $2\frac{1}{2}$ inches long, from Poko.

50. **Pellonula acutirostris** *Boulenger.*

Nine specimens, about $2\frac{1}{2}$ inches long, from Stanleyville.

51. **Pellonula tenuis** sp. nov.

Origin of dorsal over or slightly in advance of that of ventral, its last ray far in advance of anal origin. Dorsal origin much nearer snout than caudal. Dorsal 14 to 15; anal 17 to 19. Depth to base of caudal $4\frac{2}{3}$ to $5\frac{3}{5}$. Scales about 43 to 45.

The type, No. 5842, American Museum of Natural History, from Stanleyville, April, 1915, is 67 mm. long to base of caudal; depth $5\frac{2}{5}$ in this measure; head $4\frac{3}{5}$; eye 3 in head; snout 3; interorbital 4; maxillary $2\frac{4}{5}$. Body compressed, not strongly so, dorsal and ventral outlines similar. Jaws even, maxillary reaching front of eye. Adipose eyelid somewhat developed. Dorsal inserted much nearer snout than caudal, just in advance of ventral origin; its longest ray $1\frac{1}{2}$ in head. Pectoral $1\frac{4}{5}$, extending a little more than half way to ventral. Ventral 2; anal low, its longest ray 3. Caudal forked $1\frac{1}{3}$. Dorsal 14, anal 18. Scales 45, 8 longitudinal series between dorsal and ventrals. Ventral scutes low, those before ventrals very weak, 10 + 11. Conspicuous ramifying canals on opercle and shoulder. Teeth small

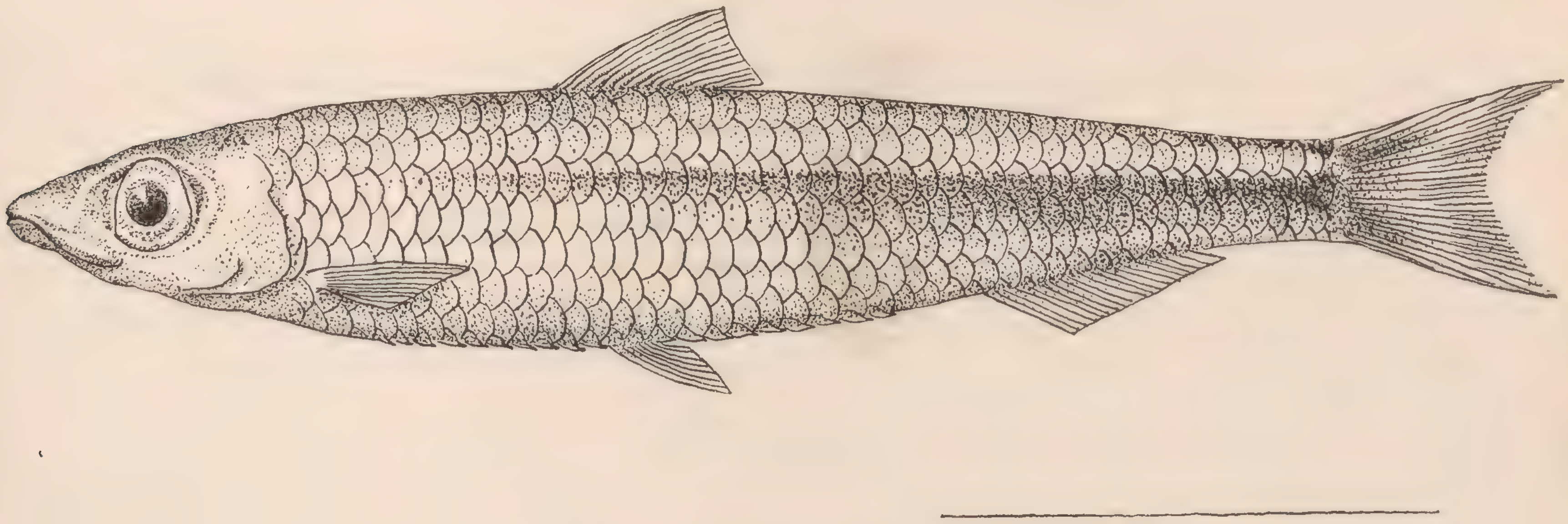


Fig. 3. *Pellonula tenuis*, type.

and weak. Color much as in *Pellonula congica,* marking less bold. Resembles *Pellonula obtusirostris* but is more slender.

Several specimens, about $2\frac{1}{2}$ inches long, from Avakubi and Stanleyville.

52. **Pellonula (Pœcilothrissa) congica** (*Regan*).

Dorsal originating slightly behind base of ventral, its last ray a little in advance of anal origin. Dorsal origin equidistant from snout and caudal. Dorsal 13 to 14, anal 18 to 20. Depth to base of caudal $3\frac{4}{5}$ to $4\frac{2}{5}$. Scales about 37.

A typical specimen, No. 5844, American Museum of Natural History, Stanleyville, April, 1915, is 60 mm. long to base of caudal; depth 4 in this measure; head $4\frac{1}{3}$; eye $2\frac{4}{5}$ in head; snout $3\frac{2}{5}$; interorbital $3\frac{1}{2}$; maxillary $2\frac{3}{5}$. Body strongly compressed, ventral outline the more arched. Jaws even, maxillary reaching front of pupil. Adipose eyelid developed. Dorsal inserted equidistant from snout and caudal, slightly behind ventral base, its longest ray $1\frac{2}{5}$ in head. Pectoral $1\frac{2}{5}$ not reaching ventral. Ventral $1\frac{1}{2}$; anal low, its longest ray $2\frac{1}{3}$. Caudal forked, slightly longer than head. Dorsal 13, anal 19. Scales loosely attached, about 35; 8 or 9 longitudinal series between dorsal and ventrals; 10 + 9 strong ventral scutes. Conspicuous ramifying canals on opercle and shoulder. Teeth in jaws of moderate or small size, sharp and somewhat unequal. Color in alcohol, pale with a whitish lateral stripe, narrower at its greatest diameter than eye. A central dark streak on peduncle forking onto the bases of the caudal lobes.

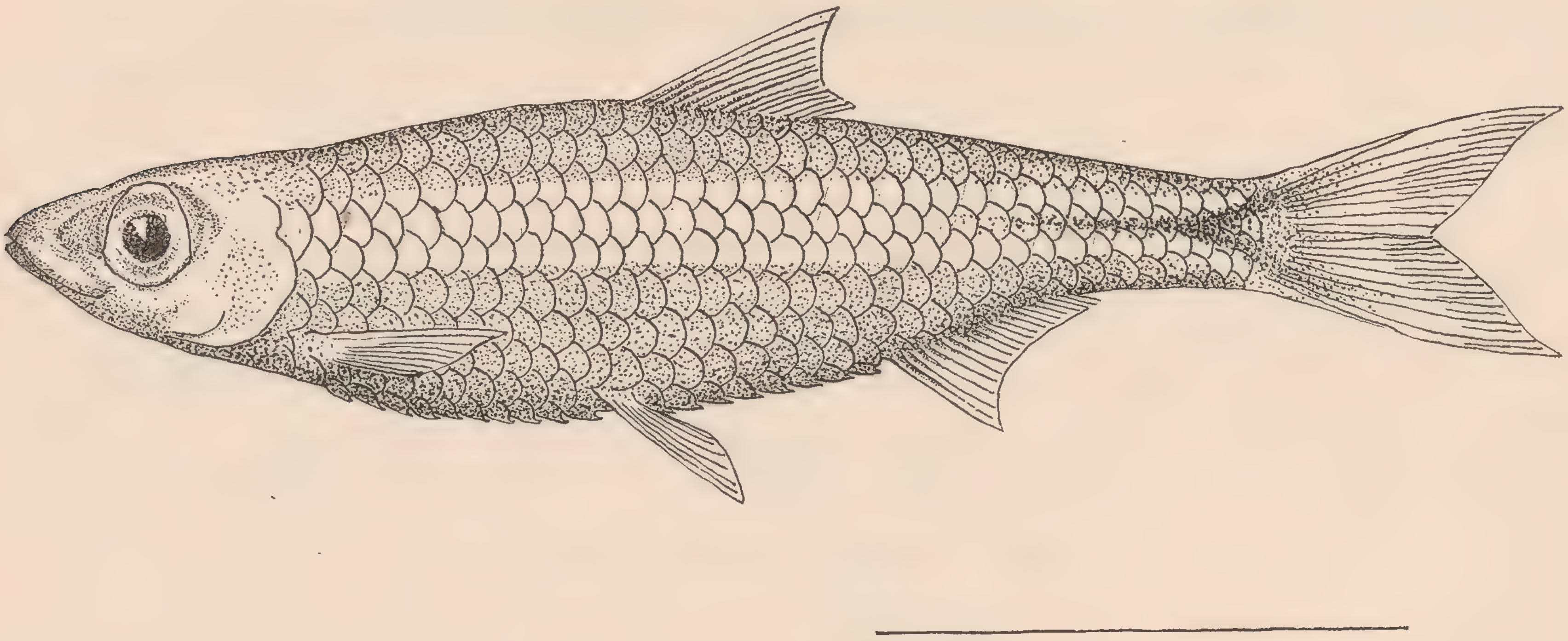


Fig. 4. *Pellonula congica* (Regan).

Intermediate between *Pellonula* (*Microthrissa*) *royauxi* and *Pellonula vorax,* which latter it greatly resembles in appearance. The description of this species and of *Odaxothrissa ansorgii* by Boulenger raises the question of the validity of the genera *Pellonula, Microthrissa* and *Odaxothrissa.* A series of forms are now known from *Odaxothrissa losera* through *Microthrissa* to *Pellonula.* In our opinion the *Odaxothrissa* type should be recognized generically but we have synonymized the intermediate *Microthrissa* with *Pellonula* to which it is very close.[1]

We have numerous specimens of *Pellonula congica,* 1 to $2\frac{3}{8}$ inches long, from Stanleyville taken in February and April, 2 from Poko in August, and 6 from Avakubi in October.

"In the vicinity of Stanleyville fishes of the genus *Pellonula* occur in immense schools near shore where they are taken by the thousand in small seines. When alive they have a glass-like, translucent appearance. In preparing them for food natives scrape off the sharp ventral scutes, otherwise they eat them entire."

53. **Pellonula (Microthrissa) royauxi** (*Boulenger*).

Several specimens, 1 to $2\frac{5}{8}$ inches long, from Stanleyville, one from Avakubi and two from Poko. This material has the eye somewhat larger than described, $2\frac{1}{3}$ to 3 in head.

54. **Odaxothrissa ansorgii** *Boulenger.*

Two specimens, about 4 inches in length, from Boma, selected from a number in the market.

55. **Odaxothrissa losera** *Boulenger.*

Several specimens, 3 to 6 inches in length, from Stanleyville.

CHARACINIDÆ.

56. **Sarcodaces odoë** (*Bloch*).

Plate LXVIII, Figs. 1, 2.

Several specimens, 5 to 10 inches in length, from Avakubi, Faradje, Poko, Rungu, Stanleyville and Zambi. This fish seems to be very generally distributed but nowhere numerous; it occurs singly, not in schools. It is a good food fish. One 7 inches long from Faradje had the following colors: Back dark brown with beautiful emerald green reflections, especially on the somewhat paler sides; ventral surface silvery white; dorsal, caudal and anal fins medium brown dotted with dark brown; gill covers silvery with green reflection; iris dark brown, with silvery edge except posteriorly.

---

[1] This paragraph was written as it stands before we had seen Regan's paper on the Clupeid Fishes of the Genus *Pellonula,* etc., Ann. Mag. Nat. Hist., Feb. 1917. Our judgment would be not to recognize his genera *Pœcilothrissa, Potamothrissa* and *Cynothrissa,* of all of which we have examined material.

57. **Hydrocyon lineatus** *Bleeker.*

Plate LXVI, Fig. 1; Plate LXX, Fig. 1.

Several specimens, 1 inch to a little less than a foot in length, from Faradje, Kwamouth, Rungu and Stanleyville. One of the largest had the following colors: Back medium brown with somewhat lighter snout and blue silvery reflections; sides yellowish silvery, whitish near ventral surface; their whole length with black points and dark blue gray longitudinal markings. Iris yellowish, suffused with dark gray above and anteriorly. Dorsal pale brown, edged with red; adipose fin black with transparent base; caudal with the base at the middle dark; upper lobe transparent brownish with a broad red margin and narrow terminal black edge; lower lobe transparent gray, its margin vermilion; pectoral, ventral and anal transparent gray, chrome orange at the tips. A color sketch by Mr. Chapin shows a silvery fish, darker along the back, with narrow blue-gray longitudinal stripes, adipose fin dusky, others margined with red, almost the entire lower caudal lobe red.

"*Hydrocyon lineatus* is called water leopard by the natives, who are not afraid of it as it is not known to attack bathers, although its formidable dentition renders it dangerous to handle. It generally swims in schools, especially when young. At low water in March and April at Stanleyville many were taken in dip-nets along the rocky ledges as they came down stream with the current. These were all about 10 inches long."

58. **Hydrocyon goliath** *Boulenger.*

Seven specimens, 3 to 8 inches in length, from Stanleyville.

59. **Bryconæthiops microstoma** *Günther.*

Plate LXVII, Fig. 2; Plate LXXX, Fig. 2 (colored).

Bryconœthiops yseuxii Boulenger.

Numerous specimens, one and a half to 5 inches in length, from Avakubi, Coquilhatville, Faradje, Niapu, Poko, Rungu, Stanleyville and Yakuluku.

One 3 or 4 inches long from Faradje had the following colors, according to Mr. Lang: Brownish, back with blue reflections; crown reddish brown; sides silvery yellow; ventral surface silvery; dorsal, anal and caudal fins dark gray, transparent; iris whitish, crossed by a vertical yellow and black bar. A fair proportion of the specimens have the black markings characteristic of the variety *boulengeri.* Several of the larger ones have the filamentous dorsal rays which are the chief character of *B. yseuxii;* others are intermediate in this respect and we do not consider *B. yseuxii* a valid species. *Bryconæthiops* occurs in schools, and in Mr. Lang's judgment perhaps one in thirty individuals has long filamentous dorsal rays.

60. **Alestes macrophthalmus** *Günther.*

Plate LXVII, Fig. 1.

One of 2¼ inches from Stanleyville, April, one of 2½ inches from Poko, August, and a 12-inch specimen from Faradje. Of this large one Mr. Lang says: "Some natives tried to catch these fish with nets. Each time they pulled the nets towards the shore the fish would leap about 4 feet above the surface of the water and perhaps 20 feet in distance, and they could not get a single one. Common close to the boulders in the river." He further notes that its color was as follows: A silvery sheen throughout; back and top of head dark greenish brown with blue reflections; sides silvery; ventral surface silvery with pink reflections; iris dark gray above, yellowish in the middle, then silvery, with an indefinite dark marking just below the pupil.

61. **Alestes liebrechtsii** *Boulenger.*

Several specimens, 2½ inches to 2 feet in length, from Avakubi, Faradje, Rungu and Stanleyville. As there are specimens of 3 or 4 inches in length from Stanleyville in February and April, Rungu in June, and Avakubi in December, it doubtless breeds throughout the year, as very likely do most of the Congo fishes.

The teeth of the small specimens resemble those of *Micralestes* more than those of the typical *Alestes.* From examination of our *Alestes, Micralestes* and *Petersius* material we would say that the dental differences given for these genera are too variable to be of generic value. We recognize the genera, however, as we have not at present the opportunity to study the teeth as carefully as Boulenger has probably done, and for the sake of convenience.

This species and other Characins which resemble it closely are always found in schools, and one frequently sees a school jump above the surface as though pursued by some larger fish.

62. **Alestes longipinnis** (*Günther*).

Several specimens, half an inch to 2 inches long, from Poko.

63. **Alestes nurse** (*Rüppell*).

Two specimens, about 5 inches long, from Garamba, taken in small brooks in the deeper pools left in the dry season.

64. **Alestes imberi** *Peters.*

Numerous specimens, ½ to about 6 inches in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. They swim in schools and have the following colors: Above medium brown; sides and gill-covers silvery; ventral area white; top of head with a tinge of green; iris pale yellowish; a blackish patch near caudal; dorsal, caudal and anal fins with yellowish or reddish tints; adipose fin reddish; pectoral and ventral fins transparent, colorless. This species bites readily, and many are caught with worms for bait on small hooks (or thorns used as hooks).

65. **Alestes schoutedeni** *Boulenger.*

Four specimens, 4 or 5 inches long, from Rungu and Faradje. One from Rungu was silvery with a broad longitudinal dark band. One from Faradje had the back dark brown, dark gray irregular markings forming the lateral band, iris dark brown with an orange edge above.

The material which we place here should perhaps be described as a new species. Our specimens are shorter bodied (depth 3 or a trifle less) with lower scale-count (23 to 25).

66. **Alestes bimaculatus** *Boulenger.*

Two specimens, 2 to 3 inches long, from Coquilhatville. Vertical fins more or less red.

67. **Alestes macrolepidotus** (*Cuvier & Valenciennes*).

Several specimens, about 1 to 9 inches in length, from Bolobo, Faradje, Poko and Stanleyville.

A color sketch by Mr. Chapin of a 5-inch specimen from Faradje shows a silvery fish, brownish olive along the back, dorsal, adipose and caudal fins, and a stripe in the center of the anal mostly orange red, the margins of these fins and a streak up the center of the caudal to the peduncle more or less dusky.

"This and several related species of *Alestes* are commonly seen swimming in schools close to the surface, along the shores of the larger watercourses (Congo, Uele, Ituri). They attract attention by a conspicuous light buff spot on the back, in about the position of the adipose fin. Yet when taken out of the water no such marking is noticeable."

68. **Alestes grandisquamis** *Boulenger.*

Several specimens. They are from Avakubi, Faradje, Poko, Rungu and two from Zambi. They range from about 3 to 8 inches in length. A large one had caudal, dorsal, adipose fin and lower portion of anal pinkish. Another of about 7 inches had the tip of snout above dark blue gray, top of head dark brown, back light brown, the brown of the upper parts turning to silvery on the sides, and the ventral surface whitish. Dorsal brownish with pink on the edges, caudal bright pink fading on the edges; pectoral, ventral and anal fins whitish, the pectorals exteriorly edged with gray. Below the eye silvery and the lower portion of the gill-covers pinkish. Iris bright yellow above turning to silvery below.

69. **Alestes carmesinus** sp. nov.

Scales 24; dorsal originating decidedly behind last ventral ray; breadth of head equal to distance from end of snout to occiput; anal III, 11; depth $2\frac{5}{6}$; lower sides and cheeks rose red.

The type, No. 6330, American Museum of Natural History, our only specimen, from Zambi, June, 1915, measures 160 mm. in length to base of caudal; depth $2\frac{5}{6}$ times in this measure, head $3\frac{3}{5}$ times. Head $1\frac{2}{3}$ times as long as broad, $1\frac{1}{4}$ times as long as deep; distance between end of snout and occiput slightly exceeding width of head; snout slightly projecting beyond lower jaw, $1\frac{1}{3}$ times as long as eye; eye lateral, its diameter 4 times in length of head, $2\frac{1}{4}$ times in interorbital width; adipose eyelid moderately developed; interorbital width $\frac{1}{2}$ length of head; maxillary reaching to under nostril, not nearly to anterior border of eye; 16 teeth $(\frac{8}{8})$ in upper jaw, 10 $(\frac{8}{2})$ in lower; lower border of second suborbital equal to diameter of eye; gill rakers rather short and slender, 15 on lower part of anterior arch. Dorsal II 8, originating well behind vertical of base of ventrals, nearer caudal than occiput; first branched ray longest, $\frac{2}{3}$ length of head; Anal III 11, longest ray $\frac{1}{2}$ length of head. Pectoral $\frac{3}{4}$ length of head, not reaching ventral. Caudal forked, with round lobes. Caudal peduncle a little deeper than long. Scales 25, 1 between lateral line and root of ventral. Color dark along the back, pale below, a black humeral spot and a black blotch on peduncle extended forward to below dorsal as a vague dark stripe; lower sides and cheeks rose red.

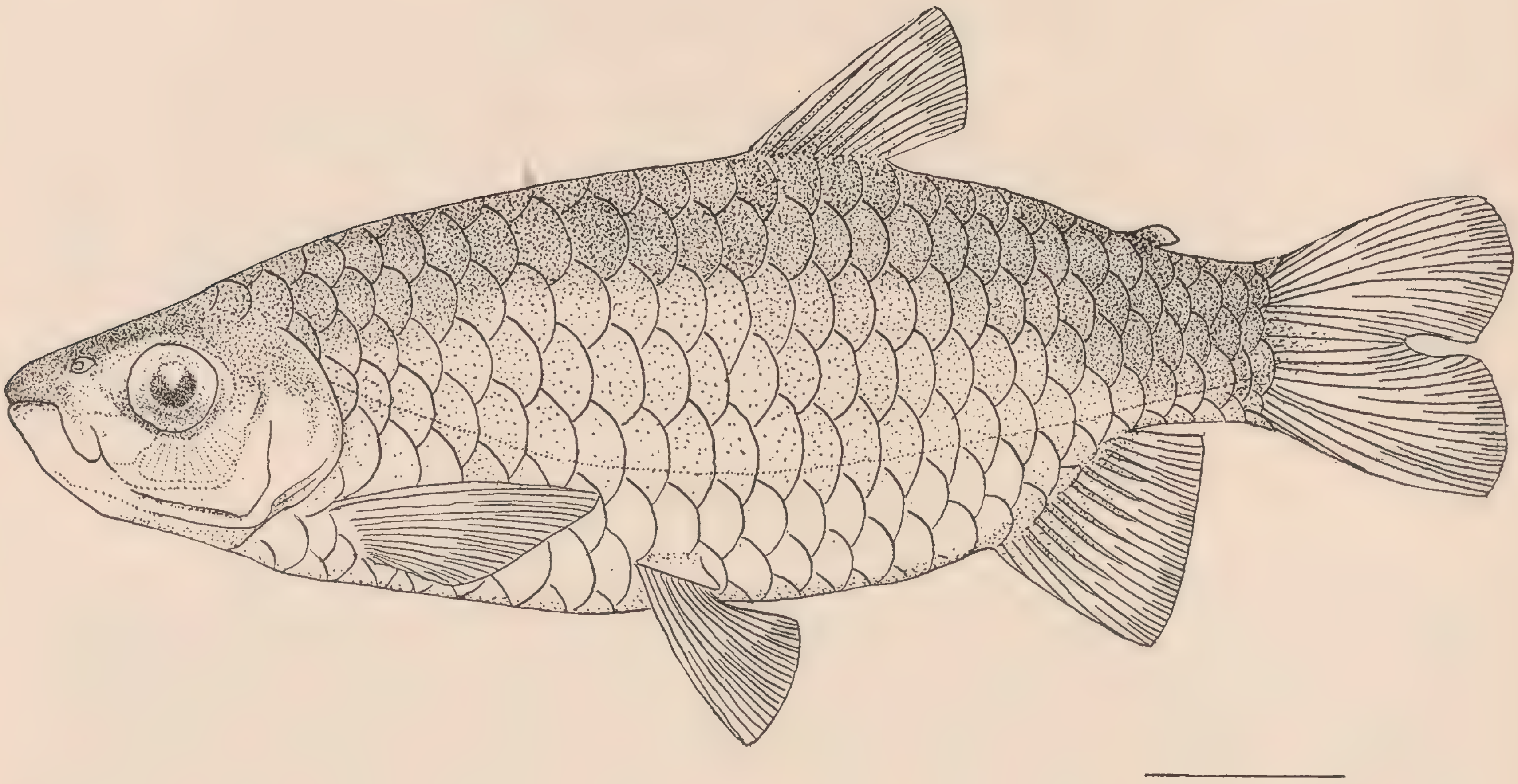


Fig. 5. *Alestes carmesinus*, type.

This species is allied to *A. grandisquamis* and *A. brevis*, being deeper than the former, with shorter anal and more numerous scales than the latter. The specimen was taken with the seine in a swampy place associated with *Polypterus*, etc.

70. **Micralestes acutidens** (*Peters*).

Numerous specimens, an inch to 3 inches in length, from Avakubi, Faradje and Poko.

71. **Micralestes stormsi** *Boulenger*.

Three specimens, 2 or 3 inches long, from Avakubi and Yakuluku.

72. **Micralestes altus** *Boulenger*.

Plate LXXXII, Fig. 2 (colored).

Several specimens, 1 to 2½ inches in length, from Avakubi, Niapu, Poko and Rungu. There is no question that our material is referable to *Micralestes altus* as described and figured by Boulenger, but we cannot find the conical teeth supposed to be present in the lower jaw and would have referred it to *Petersius*. One from Avakubi had the belly orange red.

73. **Petersius hilgendorfi** *Boulenger.*

One specimen, of 4 inches, from Coquilhatville which agrees well in technical characters with the description of this species, although differing in its color, which is well preserved, as follows: General color dark orange red, paler on the belly; dorsal, caudal, front of anal and outer edge of ventral, red; adipose fin, central caudal rays, posterior part of anal, anterior edge of pectoral, and bold vertical bar above pectoral, black; outer margin of caudal pale.

74. **Petersius caudalis** *Boulenger.*

Five specimens, 1 or 2 inches long, from Avakubi.

75. **Petersius woosnami** *Boulenger.*

Several specimens, 1 to 3 inches long, from Avakubi, Faradje, Niapu, Rungu and Stanleyville. Before being transferred from formalin to alcohol some of them had caudals more or less red margined with black.

76. **Petersius occidentalis** *Günther.*

Many specimens, $\frac{1}{2}$ to 3 inches long, from Stanleyville and a few from Avakubi, Faradje and Poko. Numerous in pools of small brooks. In formalin, a black dorsal tip and subtending yellow cross-bar were usually conspicuous; the former persists in alcohol.

Evidently one of the most abundant small fishes at Stanleyville, and it is very surprising not to find it previously recorded from the Congo, *occidentalis* being described from the Gold Coast.

In our material we find 18 or 19 rays in the anal, which is less than described but agrees with the figure. The depth of our specimens varies from $2\frac{4}{5}$ to $3\frac{3}{5}$. In some (probably males) the front of the anal is high and rounded as in the figure, in others low. Among the largest are females with eggs, from Stanleyville in April.

77. **Eugnathichthys eetveldii** *Boulenger.*

Plate LXVIII, Fig. 4.

A few specimens, about 3 to 14 inches in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. One about a foot in length from Poko had the following colors, according to Mr. Lang: Greenish brown above; sides silvery; top of head dark gray, slightly pinkish posteriorly. A number of irregular dark gray markings on the upper half of the body; those on the back tinged with greenish. Cheeks and ventral surface silvery with pinkish tint. Dorsal yellowish with dark horizontal bars. Tail pearl gray with dark bars. Pectoral and ventral fins orange; anal with a faint yellowish tinge; iris silvery white, dark above, slightly purplish below.

78. **Eugnathichthys macroterolepis** *Boulenger.*

Plate LXVIII, Fig. 3.

Several specimens, 1 to 6 inches in length, from Avakubi, Faradje, Malela, Poko, Rungu and Stanleyville. Mr. Chapin made a color sketch of one 8 inches long from Avakubi taken in a fish trap placed with the opening down stream between the rocks in rapids. It is dull greenish above, silvery on the side, whitish below, dorsal, adipose and caudal straw yellow. Two rows of roundish spots as large as eye on the upper side, bold stripes across the dorsal fin and caudal lobes, and the top of the adipose black. Fishes of the genus *Eugnathichthys* are common, occurring singly.

79. **Mesoborus crocodilus** *Pellegrin.*

Plate LXVI, Fig. 3; Plate LXXI, Fig. 2.

Ten specimens, 5 to 10 inches in length, from Coquilhatville, Faradje, Poko and Rungu. Three of 6 or 7 inches from the first-named locality have the dorsal and caudal orange in color, the back tinged with the same. One taken at Garamba was lost.

80. **Phago intermedius** *Boulenger.*

Five specimens, about 5 inches long, from Poko. Taken with the seine under overhanging trees in the Bomokandi River.

81. **Phago boulengeri** *Schilthuis.*

Plate LXVI, Fig. 4.

A few specimens from Faradje and Niapu, 1½ to 4 inches long, according to Mr. Lang "of pale gray and whitish transparent appearance."

Microstomatichthyoborus gen. nov.

Upper jaw freely movable upwards; gill-membranes free from the isthmus; scales small, ciliated; lateral line along the middle of the side; a single series of small, broad bicuspid teeth in each jaw; dorsal origin slightly in advance of origin of ventral; snout pointed, jaws even, mouth not nearly reaching eye; a scaly process at the base of the ventrals; body elongated, compressed.

This genus is evidently a small, weak-mouthed derivative of *Ichthyoborus*-like fishes. It stands intermediate between these and Pellegrin's *Hemistichodus vaillanti.*

82. **Microstomatichthyoborus bashforddeani** sp. nov.

The type, our only specimen, No. 6329, American Museum of Natural History, from Poko, August 1913, measures 63 mm. in length to base of caudal; depth $4\frac{1}{3}$ times in this measure; head $3\frac{4}{5}$ times; snout pointed; jaws equal; maxillary extending $\frac{2}{3}$ of the way to eye; snout equalling eye, which is $3\frac{1}{2}$ times in length of head and greater than interorbital width; about 12 teeth on each side in each jaw, equal in size; gill rakers moderately short and slender, few and widely spaced, 10 on lower limb of anterior arch. Dorsal II 11, originating at equal distance from end of snout and root of caudal, longest ray $\frac{2}{3}$ length of head; anal 12; pectoral and ventral fins equal, $\frac{1}{2}$ length of head. Caudal deeply forked, with pointed lobes, half covered with scales. Caudal peduncle $1\frac{1}{2}$ times as long as deep. Scales 67, 8 between lateral line and root of ventral. Lobes of the caudal with oblique black bars. Alcoholic specimen otherwise unmarked.

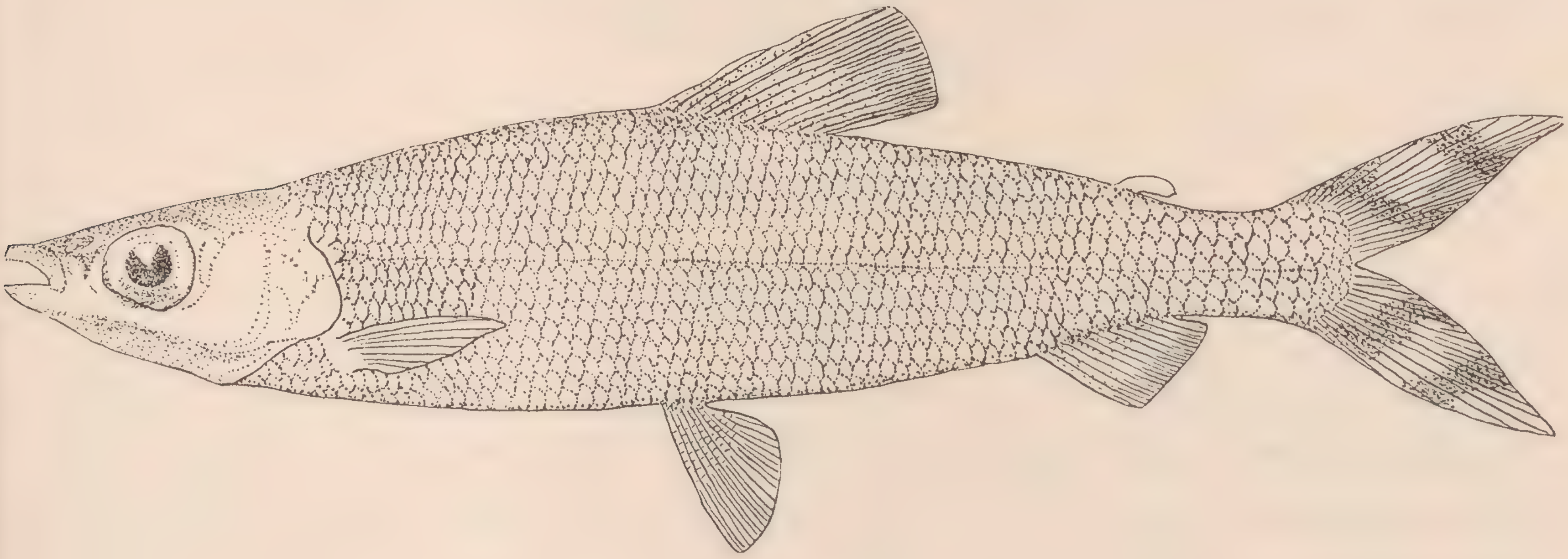


Fig. 6. *Microstomatichthyoborus bashforddeani*, type.

We take pleasure in naming this interesting species for Prof. Bashford Dean, of the American Museum of Natural History.

83. **Nannæthiops tritæniatus** *Boulenger.*

Five specimens, an inch and a half long, from Niapu.

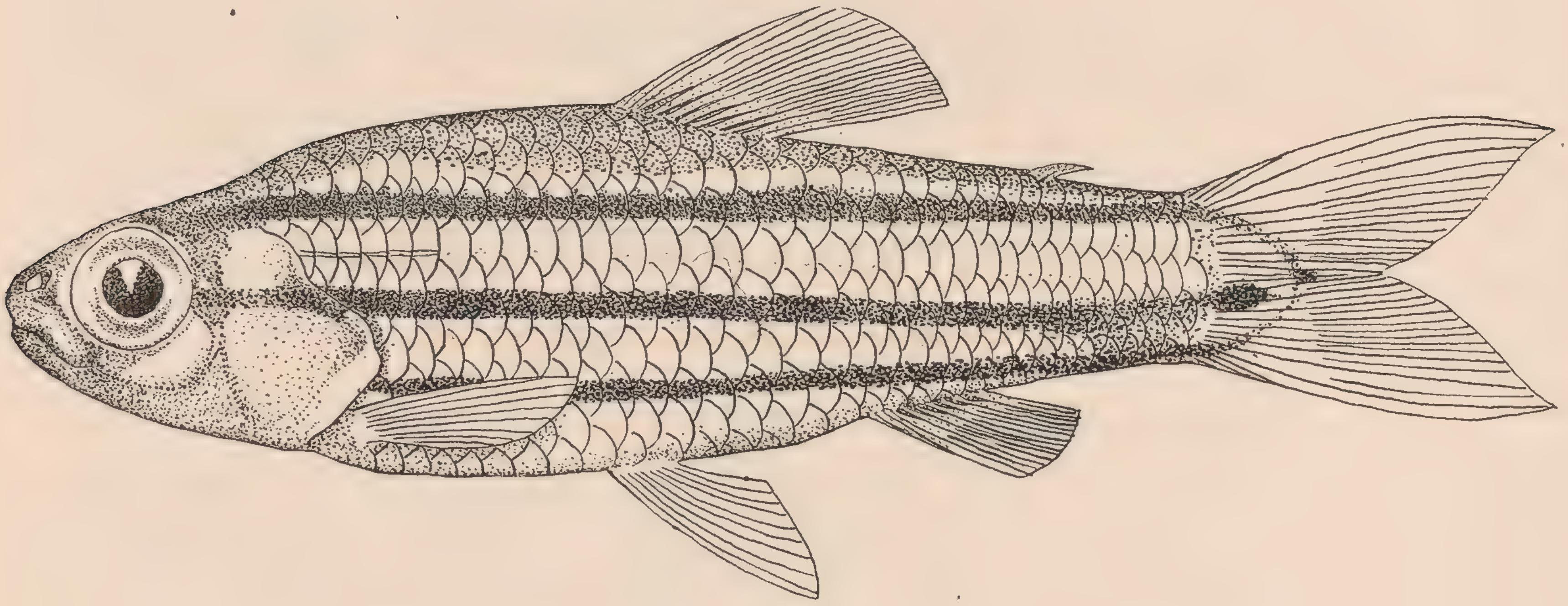


Fig. 7. *Nannæthiops tritæniatus* **(Bouleng.).**

84. **Distichodus affinis** *Günther.*

Plate LXVI, Fig. 2.

Several specimens, 1 inch to about 6 inches in length, from Avakubi, Faradje, Rungu and Poko, also a small one from Boma and three others from the lower Congo. In one of an inch and a half from Poko the following bright colors persist: Front margin of dorsal black; an area behind the margin, base of anal in front and ventral, except for a pale edge, vermilion; a faint vermilion tinge at base of caudal. Large ones, five or six inches long, from Faradje in December had the general color silvery gray to greenish brown above, whitish silvery below, many of the scales with dark gray pattern at edges. They were common in schools of fifteen to twenty, in comparatively clear water near the edge of the river, swimming near and apparently feeding from the surface.

85. **Distichodus maculatus** *Boulenger.*

Several specimens, from 2 inches to about a foot in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. Small ones, 3 inches or less, are from Stanleyville in February and April, Rungu in June, Avakubi in August, indicating at least a very prolonged spawning season. A large one from Faradje in December was gray brown above; sides silvery with darker markings; ventral surface whitish; dorsal fin gray with irregular dark markings; adipose fin dark gray; upper half of caudal fin pale grayish green, the posterior two thirds of the lower half reddish; pectoral, ventral and anal fins colorless. These fish swim near the bottom in small schools, and occur in fairly deep pools. Their yellowish fatty meat, of a rather unpleasant flavor, is relished by the natives.

86. **Distichodus antonii** *Schilthuis.*

Three specimens, 1½ to 2 feet long, and a half dozen small ones 1½ to 2 inches; one of the large ones from Faradje, the others from Stanleyville.

87. **Distichodus atroventralis** *Boulenger.*

Four small specimens, 1 to 1¾ inches, from Stanleyville, April, resemble the young of *sexfasciatus* except that their black cross-bars are narrower and the anal pale.

88. **Distichodus fasciolatus** *Boulenger.*

The most abundant of the genus, especially at Stanleyville, and very variable. Numerous specimens, 1 inch to 2 feet in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. Those 3 inches and under are from Stanleyville and Avakubi in February, Stanleyville in April, Poko and Avakubi in August, indicating at least a very prolonged spawning season. Occurs in schools, most often in the deeper muddy parts of the river near the bottom. Its meat, which resembles that of *maculatus, sexfasciatus,* and *lussoso,* is relished by the natives. Its habits are very like those of these last two species, and the three are often taken together.

89. **Distichodus langi** sp. nov.

Plate LXIX.

Scales 71; snout deeper than long, feebly compressed; dorsal 27; anal 13; interorbital width equal to length of snout; 12 scales between lateral line and ventral; depth 2¼ to base of caudal; base of dorsal twice as long as its distance from adipose fin.

The type, No. 5915, American Museum of Natural History, Faradje, December 1912, is 510 mm. to base of caudal; depth 2¼ times in this measure, head 5 times.

Head 1⅔ times as long as broad; snout feebly compressed, rounded, about equal to postocular part of head, about 2½ times diameter of eye; eye 5¼ times in length of head; interorbital width 2⅓ times in length of head; maxillary extending to below nostrils; teeth in two series in each jaw, those of the inner very small, 16 in outer series. Dorsal 27, its origin much nearer occiput than caudal, its base twice as long as its distance from adipose fin, the longest ray only ¾ length of head. Anal 13, its base much shorter than that of dorsal. Pectoral shorter than head. Caudal forked with obtusely rounded lobes. Caudal peduncle 1⅓ times as deep as long. Scales 71, 12 between lateral line and ventral.

The collector, Mr. Lang, in whose honor this species is named, supplies the following notes on its coloration and habits: "Fins dark slate color; under surface white; back and sides grayish with silvery blue and purple reflections; top and sides of head dull, dark greenish; gill-covers silvery with pale purple reflections; iris dark brown with some red above. Evidently swimming in schools, as five of them have been killed by one explosion."

Besides the type we have one other specimen with the same data measuring 325 mm.

This species is closely related to *D. mossambicus*, from which it differs in the greater breadth of the head, less slender snout, smaller eye, position of the nostril, less high dorsal, and coloration.

90. **Distichodus sexfasciatus** *Boulenger.*

Several specimens, about 1½ to 8 inches in length, from Avakubi, Faradje, Rungu and Stanleyville.

91. **Distichodus lusosso** *Schilthuis.*

Plate LXXX, Fig. 3 (colored).

Several specimens, 1½ feet down to 3 inches in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville.

92. **Nannocharax brevis** *Boulenger.*

Two specimens, 1½ inches long, from Stanleyville, taken in a small forest brook, which we place with this species have a higher scale count (42) than given by Boulenger.

93. **Nannocharax fasciatus** *Günther.*

A half dozen specimens, 2 or 3 inches long, from Avakubi.

94. **Nannocharax elongatus** *Boulenger.*

A half dozen specimens, 2 to 4 inches long, from Avakubi, Faradje and Poko.

95. **Nannocharax tænia** *Boulenger.*

A half dozen specimens, 1½ to 3 inches long, from Poko, Faradje and Niapu. Those from Poko were taken in a forest river, from Niapu in a small forest brook.

96. **Citharinus congicus** *Boulenger.*

A dozen specimens, ½ inch to 20 inches long, three from Faradje, the others from Stanleyville.

97. **Citharinus gibbosus** *Boulenger.*

Plate LXVII, Fig. 1.

Several specimens, 1 inch to a little less than a foot long, from Avakubi, Faradje and Stanleyville. One of 3 inches was silvery throughout, light brown above. Fishes of the genus *Citharinus* are generally distributed throughout the river. Large schools of young occur in the headwaters and swampy places, even papyrus swamps.

CYPRINIDÆ.

98. **Labeo weeksii** *Boulenger.*

Several specimens, about 1 to 10 inches in length, from Avakubi, Faradje and Stanleyville.

99. **Labeo lineatus** *Boulenger.*

Several, 1 inch to about 15 inches in length, from Stanleyville. One of 6¼ inches when transferred from formalin had rows of orange spots between the bold, black longitudinal stripes, fins dark wine red. Boulenger describes the lips of *lineatus* as without plicæ, like those of *weeksii.* Our two large ones (6¼ and 15 inches) have the lips with plicæ, but we think our identification is correct.

100. **Labeo longipinnis** *Boulenger.*

Plate LXXIII.

Labeo velifer Boulenger.

Three specimens from Stanleyville, 1½ to 6 inches long; and others 8 or 9 inches to over 2 feet (*velifer*) from Stanleyville, Faradje (one) and Rungu (one, the largest). We are convinced that *velifer* is the adult of *longipinnis*, the barbels becoming obsolete and disappearing with age. One a foot long has a rudimentary barbel.

The largest (Rungu, June), about 28 inches, had the following colors: General color a beautiful pink, each scale with an emerald green edge, the back darker throughout, somewhat purplish. The dorsal fin dark blue gray with paler areas, especially the rays, the caudal dark blue gray, somewhat purplish, pectoral and ventral grayish above, paler below; anal fin dark blue gray with lighter base. Top of head purplish gray, snout pale gray and white, cheeks white, gill covers gray. Breast and belly whitish with a few greenish tints. Iris silvery with pale orange tints.

In Faradje this species is caught by natives in traps set between the rocks of rapids. Like all the Labeos, it is good eating.

101. **Labeo coubie** *Rüppell.*

Two specimens, about 5 and 8 inches long, from Stanleyville. Evidently a widely distributed fish, which it is not surprising to find in the Congo.

102. **Labeo macrostoma** *Boulenger.*

Plates LXXI and LXXIV.

Five specimens, about 3 inches to a foot and a half long, one from Faradje, the others from Stanleyville. Another of about 3 feet from Rungu was photographed and not preserved. General color grayish purple with pinkish tints and greenish bases to the scales, lower sides and ventral surface white. Tip of snout whitish. Fins more or less yellowish.

103. **Labeo cyclopinnis** sp. nov.

A small barbel on each side; inner surface of lips with transverse plicæ; eyes perfectly lateral; dorsal with concave upper edge; depth of body 3⅙ times in length to base of caudal; dorsal strongly falcate, the longest ray 1¾ to 2 times length of head, anterior margin strongly curved; 20 scales around caudal peduncle which is much deeper than long.

The type, No. 6296, American Museum of Natural History, from Stanleyville, February 1915, is 119 mm. in total length; depth 3⅙ times in this measure, head 3⅗ times, 1⅖ times as long as broad; snout rounded, its length ½ that of head; eye perfectly lateral, 3¾ times in length of head; interorbital width 2⅙ times in length of head; width of mouth with lips 2¾ times in length of head; lips with transverse plicæ; lower lip with a fringe of conical papillæ; rostral flap large, with denticulate edge; a small barbel in the corner of the mouth. Dorsal III 11, nearer caudal than end of snout, falcate, longest ray 1¾ times length of head. Anal III 5, extending beyond root of caudal. Pectoral ⅘ length of head, not reaching ventral, the first ray of which falls below 5th branched ray of dorsal. Caudal deeply emarginate, crescentic when fully spread out. Caudal peduncle much deeper than long. Scales 40, 5½ between lateral line and root of ventral, 7½ between lateral line and dorsal origin, 20 around caudal peduncle. Olive above, lighter below; fins grayish; an indistinct darker area on the peduncle.

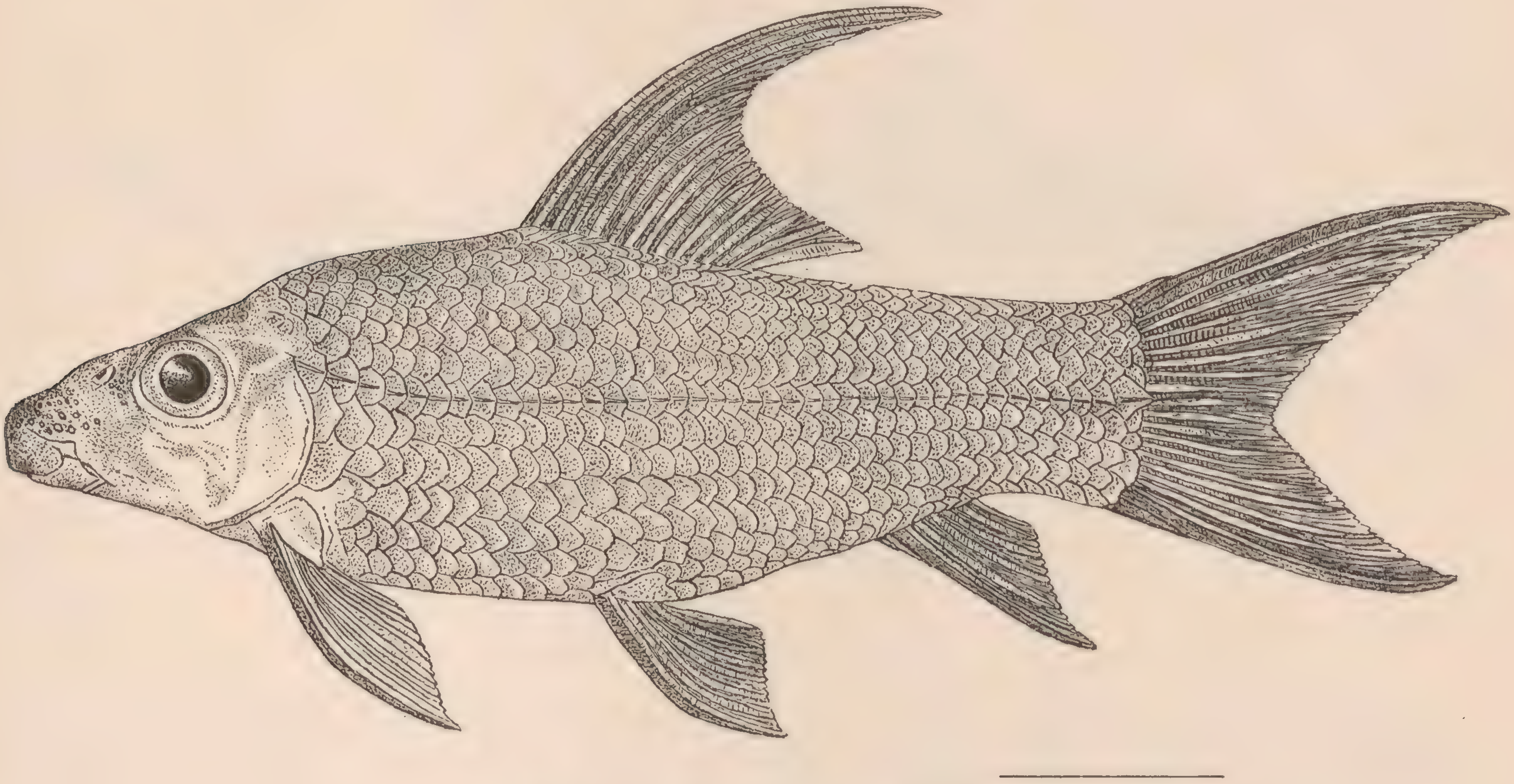


Fig. 8. *Labeo cyclopinnis*, type.

Besides the type we have four other specimens, slightly smaller with the same data.

This species is most closely related to *L. neumanni* and *L. gregorii*, from which it differs in the high dorsal and deep caudal peduncle.

104. **Labeo sorex** sp. nov.

Eyes exceedingly small; a small barbel; lips with transverse plicæ; eyes superolateral; dorsal with concave upper edge; with 9 branched rays; 20 scales around caudal peduncle.

The type, our only specimen, No. 5941, American Museum of Natural History, Stanleyville, February 1915, is 352 mm. to base of caudal; depth 4½ in this measure; head 5 times, its width slightly less than its length; snout blunt, with a sharply upturned knob at its end, which is continuous with the large rostral flap in front and separated by a deep groove from the head behind; eye minute, supero-lateral, 13 times in length of head, 7 times in interorbital width; width of mouth with lips $\frac{5}{9}$ length of head; lips with transverse plicæ, the lower with a fringe of small papillæ, and with broad irregular crenulations behind; edge of rostral flap feebly denticulate; a small barbel; spiny tubercles or their crater-like pits on snout, cheeks and whole top of head. Dorsal III 10, somewhat falcate, much nearer end of snout than caudal, longest ray 1⅓ times length of head. Anal III 5, not quite reaching caudal. Pectoral as long as head, not reaching ventral, the first ray of which is below 5th soft ray of dorsal. Caudal deeply notched, crescentic. Caudal peduncle a little longer than deep. Lateral line poorly developed. Scales 45, 6 between lateral line and root of ventral, 20 around caudal peduncle. Uniform brownish olive, lighter below.

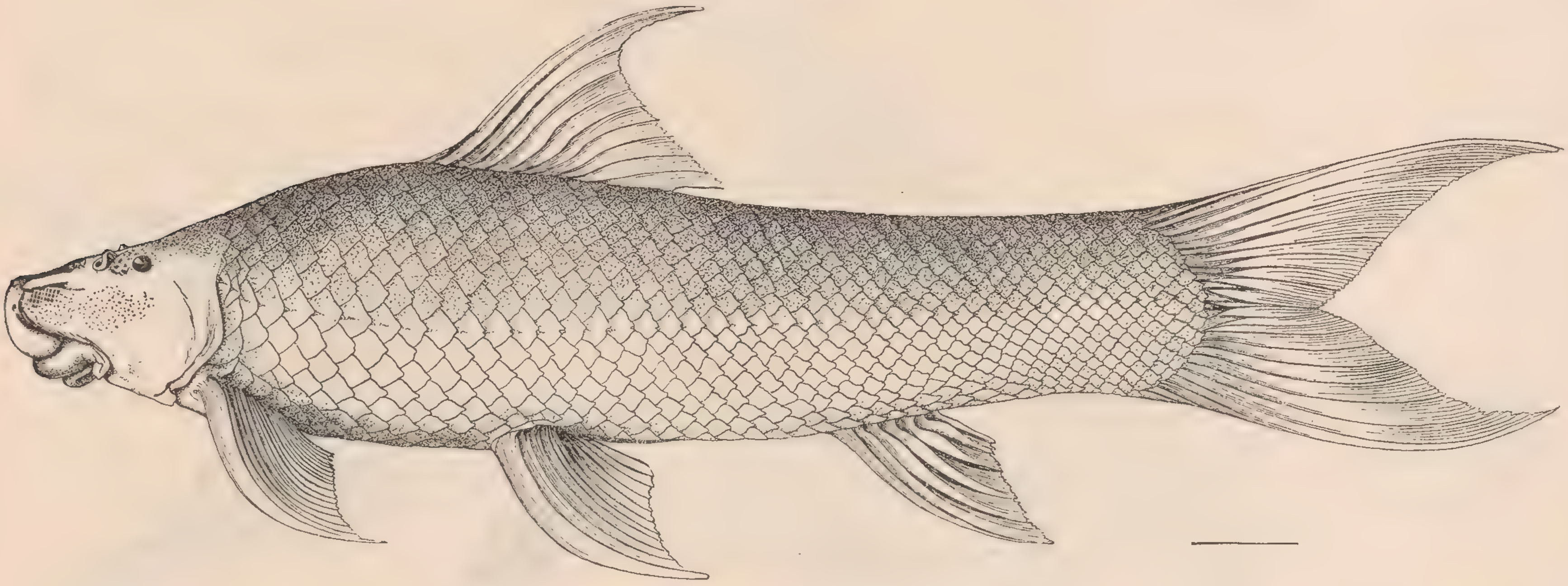


Fig. 9. *Labeo sorex*, type.

This aberrant form is remarkable for its minute eye, which readily distinguishes it from all other African Labeos. We suspect that the small eye is correlated with more or less burrowing habits, an hypothesis borne out by the smooth, callous anterior surface of the snout. It has apparently been derived from the *falcipinnis-kirkii* group, than which it has a larger number of scales.

105. **Labeo falcipinnis** *Boulenger*.

Three large specimens, about 2 feet in length, from Faradje and Stanleyville. If we are correct in our identification of one of the two Stanleyville specimens the species is a variable one. This fish differs from the others in lack of tubercles on the snout, shorter dorsal rays, more anterior pectorals and the proportion of the eye, which is also more lateral. The width of its mouth is contained three times in the head.

106. **Labeo kirkii** *Boulenger.*

A specimen 20 inches long from Stanleyville. The species was described from East Africa.

107. **Labeo forskalii** *Rüppell.*

Three specimens, one about 3, the others 7 or 8 inches long, from Stanleyville. Previously known from the Nile drainage. The related forms *falcipinnis, kirkii,* and *forskalii* seem specifically separable; as we have all three from Stanleyville they are not geographically separable.

108. **Labeo nasus** *Boulenger.*

A half dozen specimens, 4 or 5 inches long and one of about 14 inches, from Stanleyville.

109. **Labeo greenii** *Boulenger.*

Plate LXXV, Fig. 1.

Several specimens, 2 inches to a foot in length, from Avakubi, Faradje and Stanleyville. One from Faradje had the following colors: Above dark grayish green with bluish reflections, upper half of sides the same, lower half silvery, each scale with a pink cross stripe, ventral surface whitish. A color sketch by Mr. Chapin of another, 14½ inches long, shows a fish without metallic color, the sides green, each scale with a pink center, a large black blotch on the peduncle, ventral surface dull whitish, caudal fin bluish, other fins and head brownish, the fins all tipped with dull salmon.

110. **Labeo parvulus** *Gilchrist & Thompson.*

A half-dozen specimens, 6 inches or so in length, from Avakubi. A color sketch by Mr. Chapin shows a uniform slaty blackish fish, with fins of the same color, the iris with red. Our identification of this material with the South African species is perhaps open to question, but it differs from the other Congo forms and we find no good characters to separate it from *parvulus.*

111. **Labeo annectens** *Boulenger.*

Several specimens, about 3 to 5 inches long, one from Stanleyville, the others from Avakubi.

112. Labeo chariensis *Pellegrin.*

Plate LXXV, Fig. 2.

Nine specimens, about 5 inches to a foot long, from Avakubi, Faradje and Stanleyville. One of these, about 10 inches long, from the Dungu River at Faradje, when placed alive in a basin of water kept close to the bottom with the ventral and pectoral fins spread. The species was said by natives to feed on grass on the submerged rocks. In color the back was dark grayish green, nearly black, with bluish reflections; sides of head grayish blue; sides dull silvery gray with bluish edges on the scales; iris dark brown with a narrow silvery ring about the pupil; dorsal fin gray; caudal fin brownish with a tinge of red; pectorals and ventrals grayish green. Previously known from Cameroon and the Gold Coast.

113. Labeo intermedius sp. nov.

A small barbel on each side of the mouth; lips with transverse plicæ; eyes supero-lateral; dorsal with concave upper edge; 12 scales around caudal peduncle, which is but slightly longer than deep; longest dorsal ray 1⅔ times as long as head; eye 2⅓ times in interorbital width; depth 5 times in length to base of caudal.

The type, No. 6032, American Museum of Natural History, Stanleyville, February 1915, is 178 mm. to base of caudal; depth 5 times in this measure, head 4⅕ times; head 1½ times as long as broad; snout very prominent, upturned, with numerous tubercles; eye supero-lateral, in second half of head, 5 times in length of head, 2⅓ times in interorbital width; inner surface of lips with numerous transverse plicæ; a minute barbel, hidden in the folds at the side of the mouth. Dorsal II 10, falciform, deeply notched, anterior rays prolonged, 1⅔ times length of head. Anal II 5. Pectoral a little shorter than head, not reaching ventral. Caudal deeply forked, cres-

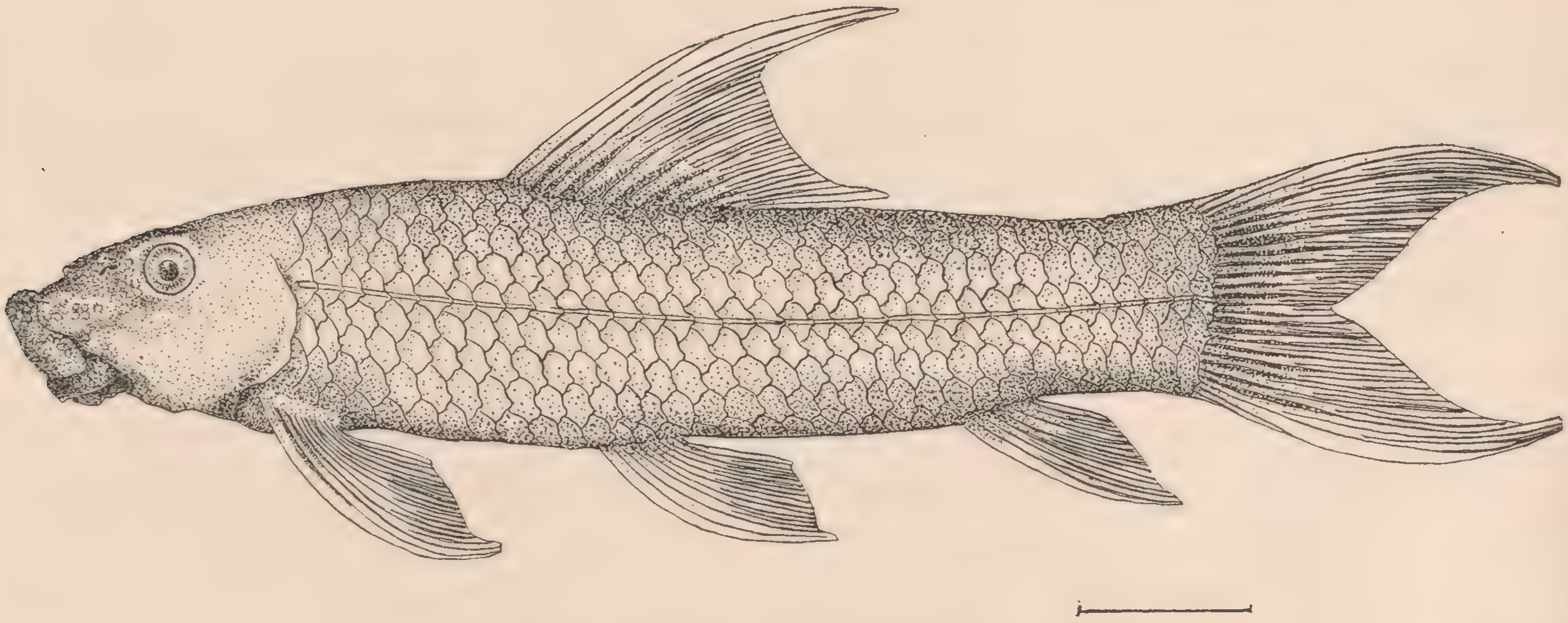


Fig. 10. *Labeo intermedius*, type.

centic when spread. Caudal peduncle a little longer than deep. Scales 35, 3 between lateral line and root of ventral, 12 around caudal peduncle. Olive brown, lighter below.

This species closely resembles *L. chariensis,* from which it differs in the slenderer body and greater interorbital width.

There is one other specimen, 4½ inches long, from Rungu.

114. **Labeo parvus** *Boulenger.*

Plate LXXXI, Fig. 2 (colored).

A small, abundant species. Numerous specimens, ½ to about 7 inches in length, from Avakubi, Faradje, Garamba, Rungu and Stanleyville.

One 4 or 5 inches long from Faradje kept the following bright colors; A broad black band from snout to caudal with paler bands above and below; dorsal tipped with orange; ventrals and pectorals suffused with red. Field color notes on another of about the same size also from Faradje are: Back yellowish brown; head above dark gray; sides yellowish, except a dark gray longitudinal band along the middle, darker near the tail.

The following note accompanies a color sketch by Mr. Chapin reproduced in this paper: "I have seen this fish alive in the Dungu and Uele Rivers about the rocks at low water. The blackish stripe is conspicuous."

115. **Labeo ogunensis** *Boulenger.*

Five specimens, from 4 to 6 inches long, from Avakubi. They agree with the description of *ogunensis* from Lagos except for the head which is a little longer, contained 4 times in the length instead of 4½.

116. **Labeo ansorgii** *Boulenger.*

A single small specimen, an inch and a half long, from Stanleyville. The species is described from Angola.

117. **Discognathus dembeensis** (*Rüppell*).

A half dozen specimens, 2 to 4 inches in length, from Avakubi and Faradje It is interesting to find this species, known from Nile and East African drainage, in the headwaters of the Congo.

118. **Discognathus ornatus** sp. nov.

Pupil of eye in the middle of the length of head; mental disk well developed; eye lateral, visible from below; barbel minute; ventrals below middle of dorsal; caudal peduncle 1½ times as long as deep; scales 37; a black and white banded caudal.

The type, our only specimen, No. 6135, American Museum of Natural History, Stanleyville, February 1915, is 30 mm. long to base of caudal; body compressed, its depth 6½ times in this measure; head depressed, 1½ times as long as broad, its length 4¼ times in total length; snout rounded, interorbital region nearly flat; eye lateral, in middle of head, its diameter 4 times in length of head and 1½ times in interorbital width; width of mouth ⅓ length of head; lips well developed, the lower forming a fold embracing a mental disk, which is broader than long; two small barbels on each side, the anterior not more than ½, the posterior not more than ⅓ diameter of eye. Dorsal III 7, equally distant from eye and caudal, emarginate, longest ray slightly shorter than head. Anal II 5. Pectoral a little shorter than head, widely separated from ventral, which is situated below middle of dorsal. Caudal deeply emarginate. Caudal peduncle 1½ times as long as deep. Scales 37, 3 between root of ventral and lateral line, 16 around caudal peduncle. Dusky olive above, yellowish below; cheeks, opercle and sides below lateral line thickly speckled with minute dark spots; dorsal black at base, and a broad black bar across the middle; base of caudal and tips of lobes pale, otherwise black; other fins pale; a black blotch on the caudal peduncle at base of caudal.

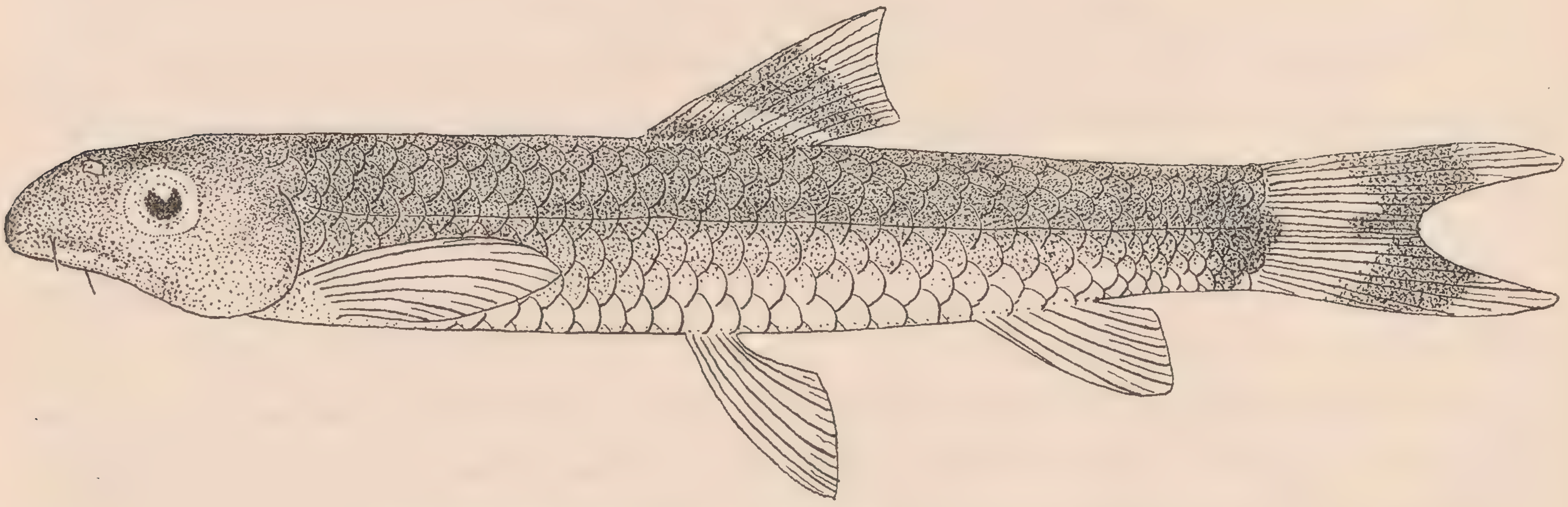


Fig. 11. *Discognathus ornatus*, type.

This species differs from *D. dembeensis* by its lateral eye and from *D. vinciguerræ* and *D. makiensis* by the smaller barbels. The coloration which would separate it readily from any species may be a juvenile character.

119. **Barbus fasolt** *Pappenheim.*

Plate LXXII.

Two specimens, 5 inches long, from Niangara have a slightly larger eye than the description of *fasolt*, which is to be expected from their much smaller size than specimens described. Posterior barbel about equal to eye in length. We prefer to place them here rather than to describe them as new, as also a large specimen about 2 feet long from Stanleyville. This latter has a high scale-count, 28 or 29, and approaches *cookei* in some other respects. We also identify provisionally as *fasolt* a large specimen from Faradje, with a deep peduncle, of which only photographs were preserved. Probably too many species of this form of *Barbus* are recognized, owing to considerable individual variation.

120. **Barbus caudovittatus** *Boulenger.*

Nine specimens, about ½ inch to 8 inches in length, from Avakubi and Faradje.

121. **Barbus holotænia** *Boulenger.*

Plate LXXXI, Fig. 1 (colored).

Evidently one of the commonest of the genus. Specimens about 1½ to 5 inches in length are from Avakubi, Bafwabaka, Faradje, Garamba, Niangara, Niapu and Stanleyville. Occurs in schools at the edge of the river and is caught by native boys on small iron barbless hooks.

122. **Barbus musumbi** *Boulenger.*

Three specimens, 2 or 3 inches long, from Rungu. These differ slightly in proportion of eye (not shorter than snout) and caudal peduncle (not "slightly longer than deep"), and in color in that they have a dark bar behind opercle, from the 3½ inch *musumbi* described from Angola. These are minor differences and we prefer to place them here than to describe them as new.

123. **Barbus atromaculatus** sp. nov.

Scales with radiating canals; last simple ray of dorsal not enlarged or serrated; two barbels on each side; dorsal with 8 branched rays; base of ventral below anterior rays of dorsal; pectoral not reaching ventral; scales 25–31; posterior barbel ⅘–1⅔ times diameter of eye; caudal peduncle 1½ to 2 times as long as deep; mouth terminal.

The type, No. 6295, American Museum of Natural History, from Yakuluku, November 1911, is 49 mm. to base of caudal; depth 3½ in this measure, head 4 times. Snout rounded, equalling eye, which is 3 times in length of head, and equals the interorbital width; mouth narrow, terminal; lips feebly developed; two barbels on each side, the anterior much shorter than eye, the posterior ⅘ diameter of eye. Dorsal III, 8, its origin equally distant from end of snout and from caudal, border slightly concave; last simple ray not enlarged, not serrated, about as long as head. Anal III

5, not reaching caudal. Pectoral $\frac{4}{5}$ length of head, not reaching ventral; base of the latter below anterior rays of dorsal. Caudal peduncle $1\frac{1}{2}$ times as long as deep. Scales 26, with radiating canals, 2 between lateral line and ventral, 12 around caudal peduncle. Yellowish; fins pale; some of the scales along lateral line dark at the base; a series of 3–7 black spots on each side, connected by a dark lateral streak, all but the last above the lateral line; a black spot at the root of the dorsal and anal; a black stripe around the snout, extending nearly to the eyes.

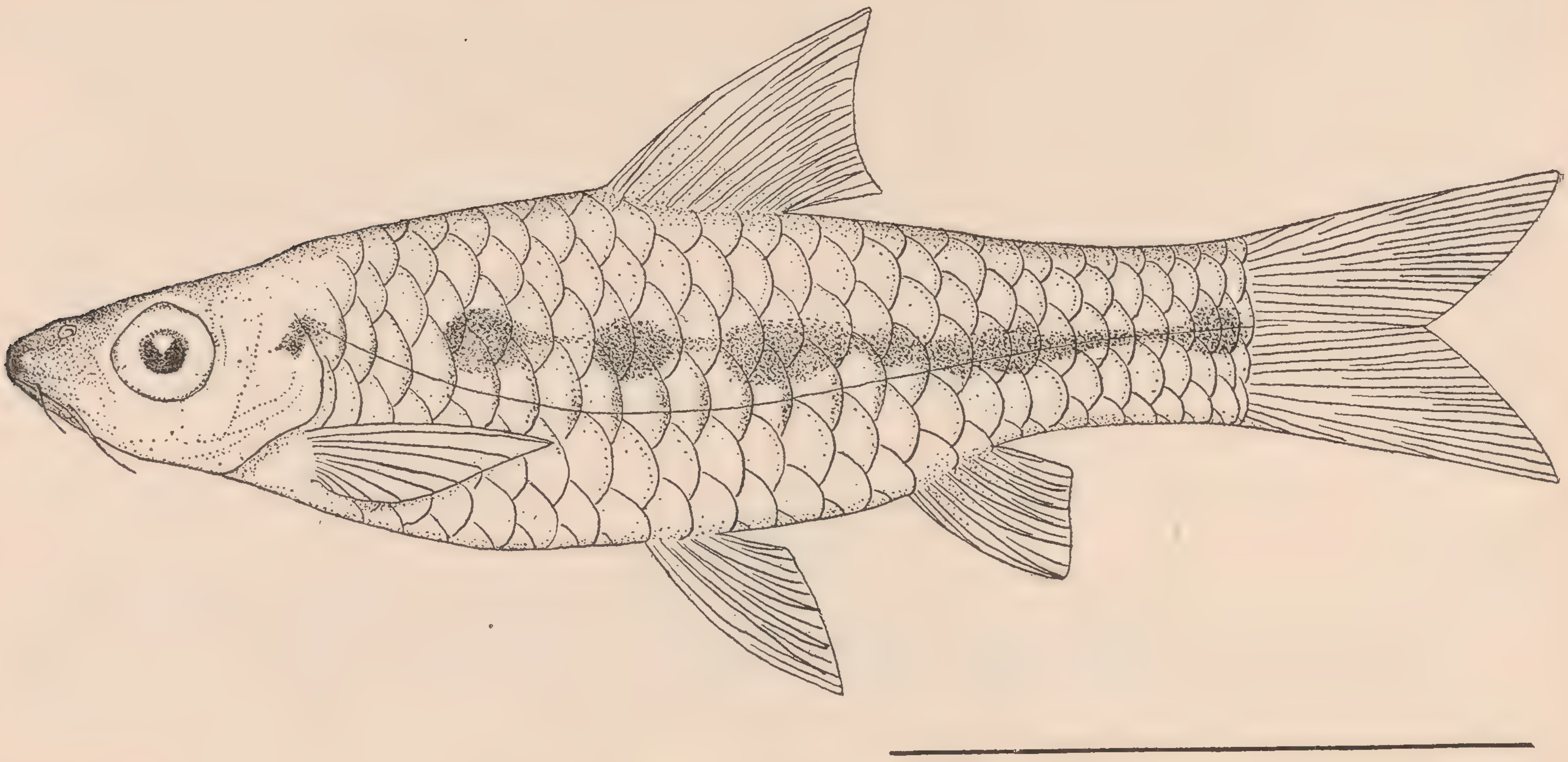


Fig. 12. *Barbus atromaculatus*, type.

Besides the type we have other specimens as follows: Four specimens, Lower Congo; five specimens, Yakuluku, November 1911; one specimen, Niapu, November 1913; seven specimens, Faradje, January 1913; one specimen, Bafwabaka, January 7, 1910; six specimens, Stanleyville, April 1915; one specimen, Stanleyville, February 1915.

This very variable species is closely related to *B. lineomaculatus* from South East Africa. Some of the slender young can scarcely be differentiated from it by any technical characters. Grown fish have a much deeper peduncle, and the bold diagnostic color pattern is fairly constant. The conspicuous black spot at the origin of the anal seems not to have been described in other related *Barbus*.

The collector, Mr. Lang, writes that this species was caught in swamps away from the main rivers.

124. **Barbus pleuropholis** *Boulenger.*

Several specimens, 1 or 2 inches long, from Avakubi, Medje, Niapu, Stanleyville and Yakuluku. All are pale in alcohol, the scales of the upper parts outlined in dark. When changed from formalin two or three specimens had an orange spot with a black front margin behind the opercle, the unpaired fins rose colored.

Examination of ten from Stanleyville in April, tabulated below, shows a scale variation of 21 to 24 and an increase of depth with age. From this it seems probable that *pleuropholis* is the young of *congicus*.

Length to base of caudal	Depth	Scale count
37 mm.	2.8	23
33	3.1	22
32	3.0	24
32	3.1	23
31	3.3	23
31	3.2	21
30	3.1	22
29	3.2	22
24	3.4	22
23	3.4	22

125. **Barbus rubripinnis** sp. nov.

Scales radiately striated; last simple dorsal ray not bony or serrated; a single barbel on each side; dorsal with 8 branched rays; barbel ½ diameter of eye; depth 4 times in length to base of caudal; dorsal bright red, tipped with white.

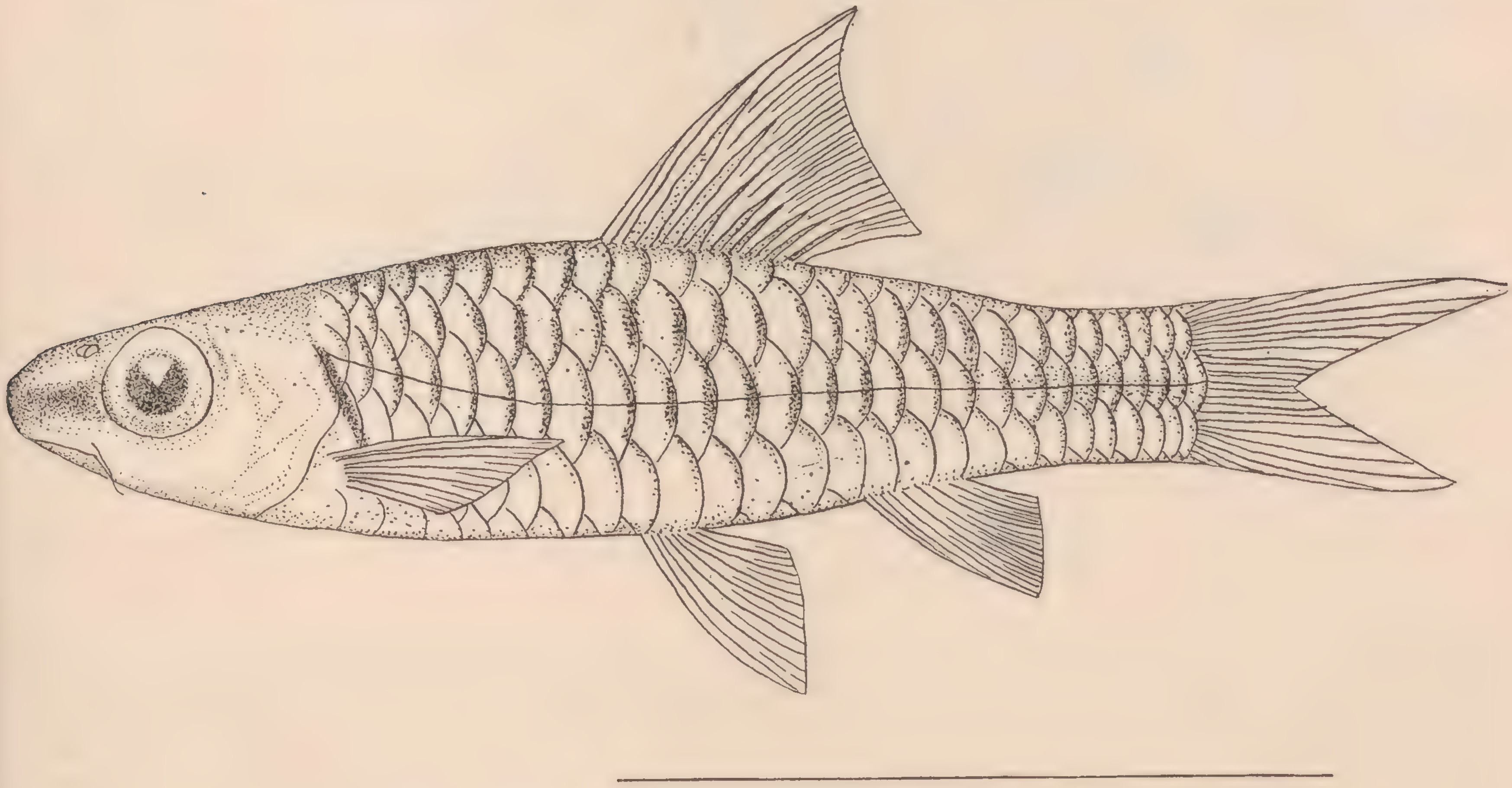


Fig. 13. *Barbus rubripinnis*, type.

The type, the only specimen, No. 6328, American Museum of Natural History, from Poko, July 1913, measures 42 mm. in length to base of caudal; depth 4 times in this measure; head 3⅔ times. Snout rounded, 3¼ times in length of head; eye

3 times in length of head, interorbital width 3½ times; mouth subinferior; lips moderate; a single slender barbel on each side, ½ diameter of eye. Dorsal III 8, equally distant from posterior margin of eye and caudal; last simple ray not enlarged or spine-like, equal to head. Anal III 5, not reaching caudal, its longest ray ⅗ head. Pectoral shorter than head, not reaching ventral, which it equals in length and which is under the middle of the dorsal and just reaches origin of anal. Caudal peduncle 1½ times as long as deep. Scales radiately striated, 27, 1½ between lateral line and ventral. Scales of the back and sides outlined with black punctulations; a black stripe from snout to eye, and a narrow black oblique bar, under the margin of the opercle; dorsal bright red, tipped with white.

Though with but a single barbel, this species seems more closely allied to the two-barbeled forms. It is notable for the deep, narrow scales on the sides.

126. **Barbus dolichosoma** sp. nov.

Scales with radiating canals; last simple ray of dorsal not enlarged or serrated; 2 barbels on each side; dorsal with 8 branched rays; base of ventral below anterior rays of dorsal; posterior barbel 1⅓ times eye; pectoral not reaching ventral; scales 24; mouth inferior; caudal peduncle 1½ times as long as deep; last simple ray of dorsal thicker than first branched ray; depth 4¼.

The type, our only specimen, No. 6137, American Museum of Natural History, Avakubi, December 1913, is 52 mm. to base of caudal; depth 4¼ in this measure; length of head 4 times; snout rounded, as long as eye, which is 3 times in head, and equals interorbital width; mouth inferior, small; two barbels on each side, the posterior 1⅓, the anterior ⅘ times the diameter of eye. Dorsal III 8, nearer occiput than caudal, border very slightly concave; last simple ray not spiny, not serrated, slightly thicker than first branched ray, shorter than the head. Anal III 5, not reaching caudal. Pectoral ¾ length of head, not reaching ventral; base of latter below anterior

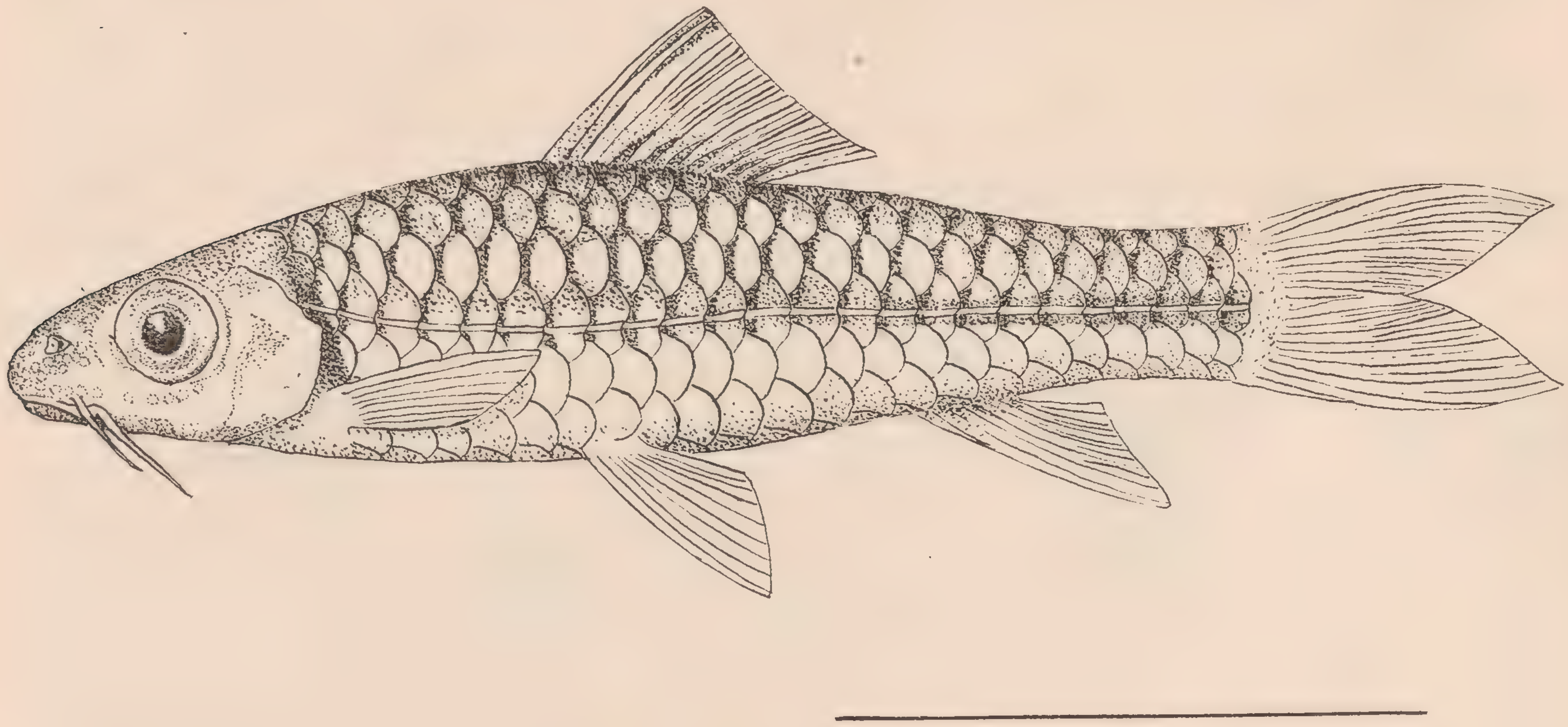


Fig. 14. *Barbus dolichosoma*, type.

rays of dorsal. Scales radiately striated, 24, 2 between lateral line and root of ventral, 10 around caudal peduncle. Caudal peduncle $1\frac{1}{2}$ times as long as deep. Olive green, lighter below; scales on the back and sides each with a black basal bar; a black bar behind the opercle.

This species is much more slender than its nearest allies. Taking into account its coloration and technical characters, it seems to be a well marked species for the genus.

127. **Barbus candens** sp. nov.

Scales radiately striated; last simple ray of dorsal not enlarged, not serrated; a single barbel; lateral line reduced to a few tubules; dorsal with 7 branched rays; pectoral not reaching ventral; depth $2\frac{2}{3}$; three large black spots on sides.

The type, No. 6046, American Museum of Natural History, Stanleyville, April 1915, is 26 mm. to base of caudal; depth $2\frac{2}{3}$ in this measure, head $3\frac{1}{2}$ times. Snout rounded, slightly shorter than eye, which is 3 times in head, and about equals interorbital width; mouth small, terminal; a single barbel on each side. Dorsal III 7, equally distant from occiput and caudal, border straight; last simple ray not enlarged, not serrated, $\frac{2}{3}$ length of head. Anal III 5, not reaching caudal. Pectoral shorter than head, not reaching ventral; base of latter below anterior rays of dorsal. Caudal peduncle $1\frac{1}{3}$ times as long as deep. Scales radiately striated, 23, 2 between lateral line series and ventral, 10 around caudal peduncle. Lateral line reduced to 3 tubules. Olive above, paler below, yellowish above anal; dorsal scales with dark basal bars; 3 black blotches on side, posterior larger, oval and below center of peduncle; dorsal white, black basally, with a black margin and pale tipped; ventrals and anal cherry red tipped with black; a black stripe across the snout.

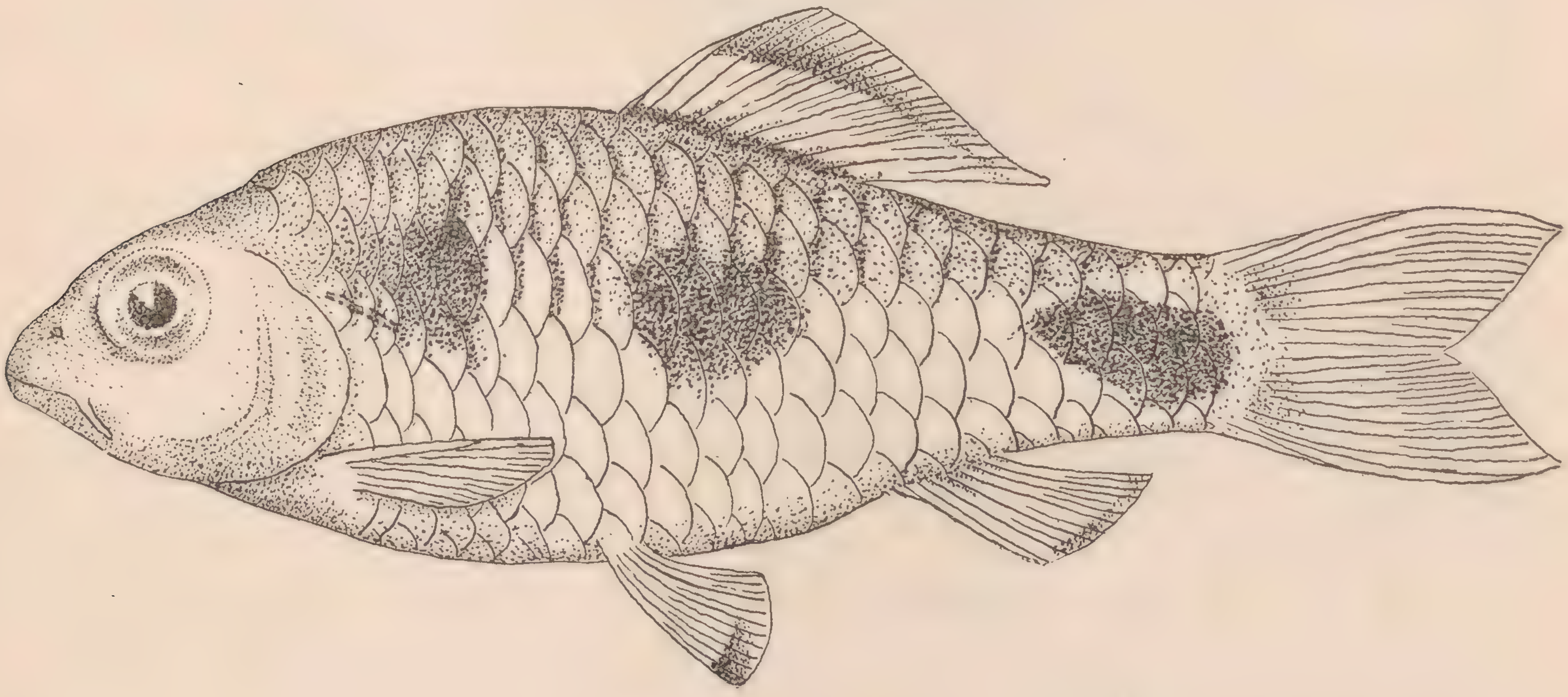


Fig. 15. *Barbus candens*, type.

Besides the type we have 54 specimens from 14 mm. to 26 mm., all with the same data. They were taken in a small shaded forest brook, an affluent of the Tshopo River.

It is remarkable that this very distinct and beautiful little species has been so long overlooked in the comparatively well-known Stanleyville area.

128. **Leptocypris modestus** *Boulenger.*

Numerous specimens, 2½ to about 4 inches in length, from Stanleyville in February and April. The largest ones are deeper than described, one especially 3¾ inches to base of caudal having the depth 4 in that measure. Schools taken near shore with *Barilius weynsii* and Pellonulas.

129. **Barilius lujæ** *Boulenger.*

Two specimens, 3 or 4 inches long, from Stanleyville.

130. **Barilius weynsii** *Boulenger.*

The most abundant of the genus. Numerous specimens, 2 to 5 inches in length, from Avakubi, Rungu and Stanleyville. A few have a narrow dark streak on the upper part of the side; when transferred from formalin many had the back and caudal orange, latter tipped with dusky.

Schools taken near shore at Stanleyville with *Leptocypris modestus* and Pellonulas.

131. **Barilius ubangensis** *Pellegrin.*

Nine specimens, about 1 to 5 inches in length, one from Medje, one from Niapu, the remainder from Avakubi.

132. **Barilius salmolucius** sp. nov.

Last ray of dorsal distinctly behind origin of anal; scales 45–46; anal with 13 branched rays; snout long, 1¼ to 2 times (in largest specimen) as long as eye, projecting slightly beyond the mouth; head large, exceeding the depth of the body; a series of vertical black blotches along the side.

The type, No. 6052, American Museum of Natural History, Stanleyville, February 1915, is 107 mm. long to base of caudal. Depth of body 5 times in this measure, length of head 3¾ times. Head 2½ times as long as broad; snout pointed, slightly projecting beyond mouth, 1½ times as long as eye, which is contained 5 times in length of head; interorbital width a little greater than diameter of eye; mouth extending almost to below posterior border of eye; no barbels; suborbital bones nearly entirely covering the cheek, the second narrow and not extending posteriorly beyond anterior quarter of eye. Gill-rakers few and short. Dorsal III 8, the posterior ray distinctly behind the origin of anal, originating midway between posterior border of eye and root of caudal; first branched ray longest, $\frac{3}{5}$ length of head. Anal III 13, first branched ray longest, $\frac{1}{2}$ length of head. Pectoral acutely pointed, $\frac{2}{3}$ length of head, not reaching ventral; latter much shorter, not reaching vent. Caudal forked, with pointed lobes. Caudal peduncle 2 times as long as deep. Scales with radiating striæ, 46, $8\frac{1}{2}$ between lateral line and origin of dorsal, $2\frac{1}{2}$ between lateral line and origin of ventral, 16 around caudal peduncle. Greenish, lighter below; 6 large square dark blotches along sides of body; fins whitish, the dorsal faintly tipped with dusky.

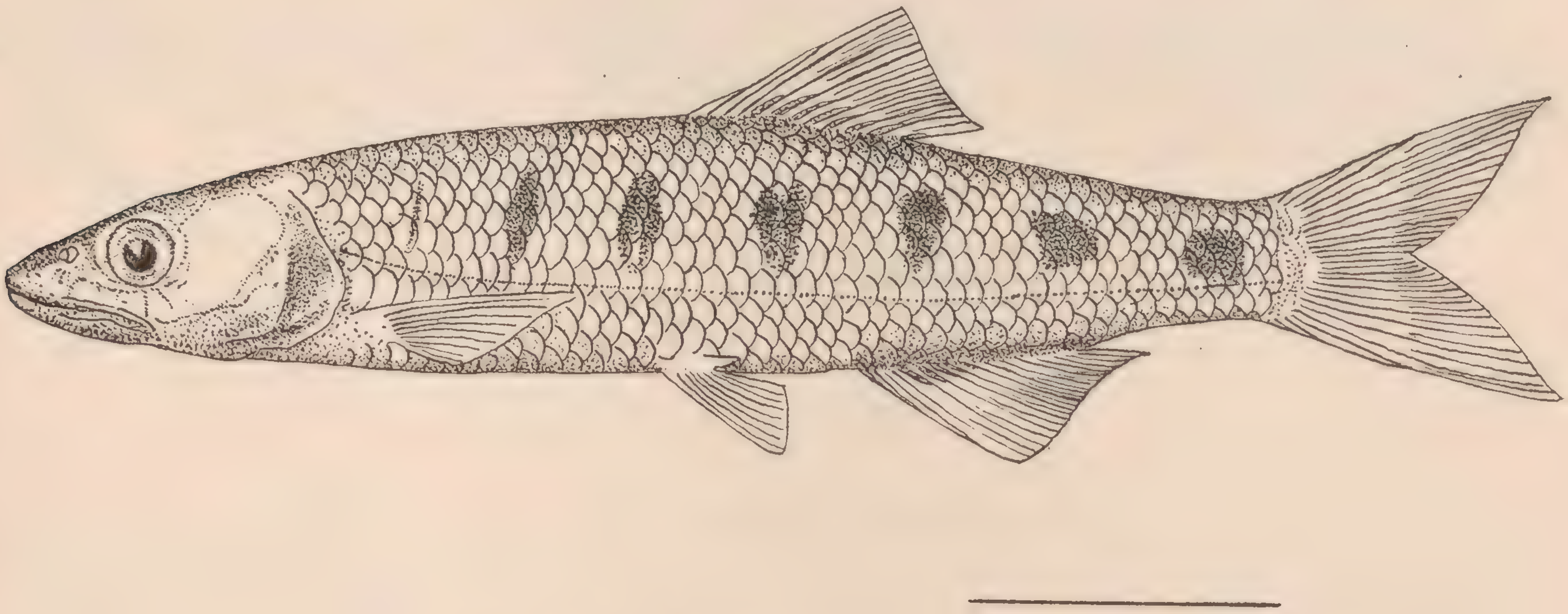


Fig. 16. *Barilius salmolucius*, type.

Besides the type we have 6 other specimens, 4 from Niangara, $3\frac{1}{2}$–5 inches long, one from Avakubi, 4 inches long; one $3\frac{1}{2}$ inches from Poko, which show the following range in measurements. Depth $4\frac{1}{2}$–$5\frac{1}{4}$; head $2\frac{1}{2}$–3; eye 4–5; longest branched anal ray $\frac{1}{2}$–$\frac{3}{5}$ length of head; caudal peduncle $1\frac{3}{4}$–2 times as long as deep.

This species is most closely allied to *B. loati* but has fewer scales. It is notable among members of this genus for the great length of the head in proportion to the depth, though in lesser degree than *B. longirostris*.

133. **Barilius kingsleyæ** *Boulenger.*

Two specimens, 2 and 5 inches long, from Faradje and Garamba respectively.

134. **Engraulicypris congicus** sp. nov.

Anal originating slightly in advance of dorsal, with 19–22 rays; scales 38–41; cleft of the mouth extending to below pupil; dorsal origin decidedly nearer caudal than head; caudal peduncle $1\frac{1}{2}$ times as long as deep.

The type, No. 6294, American Museum of Natural History, Poko, August 1913, is 51 mm. long; depth $4\frac{1}{2}$ in this measure, length of head $4\frac{1}{3}$ times; eye equals interorbital width, 3½ times in length of head; snout moderately pointed, projecting slightly beyond lower jaw, its length equal to eye; maxillary extending to below middle of eye, contained 2 times in the head. Dorsal II 7, originating further back than anal, nearer caudal than head by a distance slightly greater than diameter of eye; longest ray a little more than half length of head; Anal II 20; pectoral acutely pointed, reaching root of ventral, about as long as head. Caudal peduncle 1½ times as long as deep. Scales 38, between lateral line and root of ventral 1½, 6½ between lateral line and dorsal, 12 around caudal peduncle. Coloration pale, darker on the back.

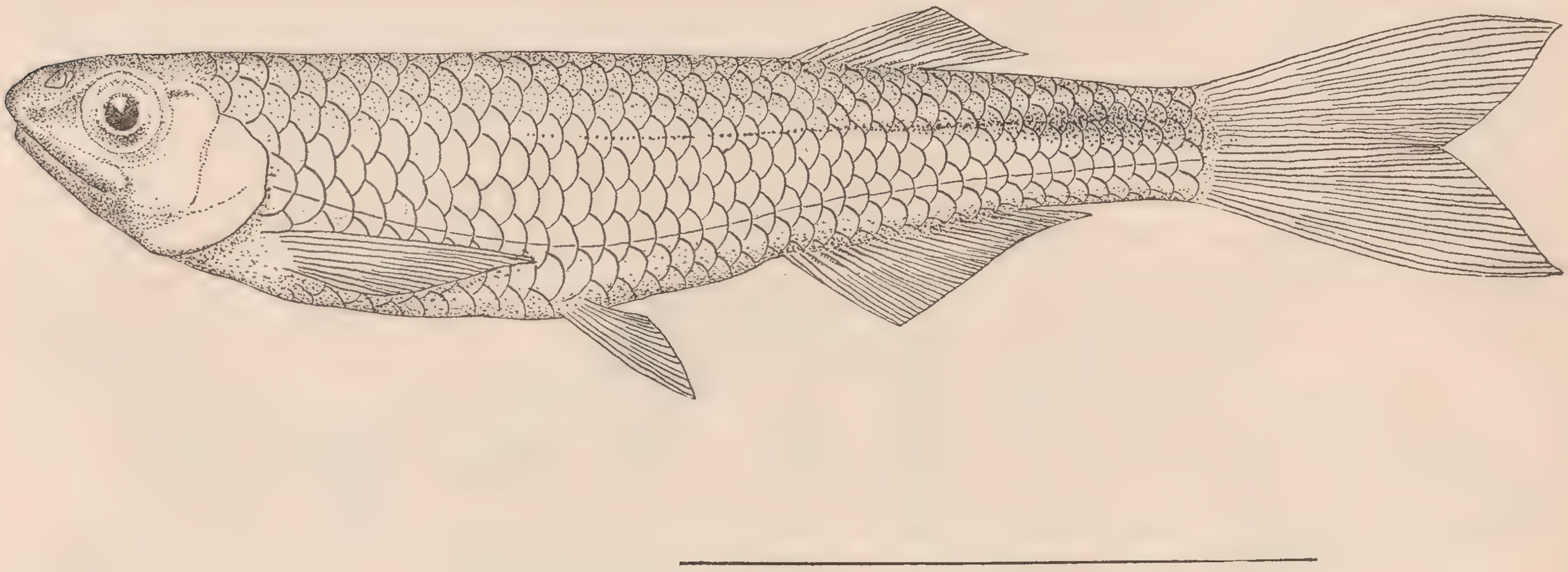


Fig. 17. *Engraulicypris congicus*, type.

Besides the type we have one specimen slightly smaller with the same data, one slightly smaller and two slightly larger from Avakubi, December 1913. This species, the first of the genus to be recorded from the Congo, is closely related to *E. minutus,* from which it differs in the slightly greater scale count, less slender peduncle, etc.

135. **Chelæthiops elongatus** *Boulenger.*

Five specimens, 2 or 3 inches long, one from Stanleyville, the others from Avakubi.

Siluridæ.

136. **Clarias lazera** *Cuvier & Valenciennes.*

One specimen a foot and a half long from the Upper Congo.

137. **Clarias zygouron** sp. nov.

Ventral fins about midway between end of snout and root of caudal or slightly nearer latter; dorsal and anal broadly adnate to and confluent with the caudal.

The type, the only specimen, No. 6698, American Museum of Natural History, from Malela, July 1915, measures 83 mm. in length to base of caudal; depth $5\frac{3}{5}$ times in this measure; head to tip of occipital process $3\frac{2}{5}$ times. Head $1\frac{1}{3}$ times as long as broad, its upper surface smooth; occipital process angular; frontal fontanelle elliptical, 3 times as long as broad, 4 times in length of head; eye 3 times in length of snout, $5\frac{1}{2}$ times in interorbital width; with a free border; width of mouth nearly equal to interorbital width; band of premaxillary teeth 4 times as long as broad; vomerine teeth forming a narrow, crescentic band, which at its broadest point is as broad as premaxillary band; nasal barbel $1\frac{1}{3}$ length of head; maxillary barbel $2\frac{1}{3}$ times length of head; outer mandibular barbel $1\frac{1}{3}$ times as long as inner, which is equal in length to the head. Gill-rakers moderately long, slender, 17 on anterior arch. Dorsal about 47, its distance from occipital process $\frac{1}{3}$ length of head, adnate to and confluent with caudal. Anal about 40, adnate to and confluent with caudal. Pectoral $\frac{4}{7}$ length of head, the spine feebly serrated on its outer border, and strongly on the inner, $\frac{3}{4}$ the length of the fin. Ventrals about half-way between end of snout and root of caudal. Caudal bluntly pointed, $\frac{1}{2}$ length of head. Dusky olive above, paler below; fins except ventrals dark.

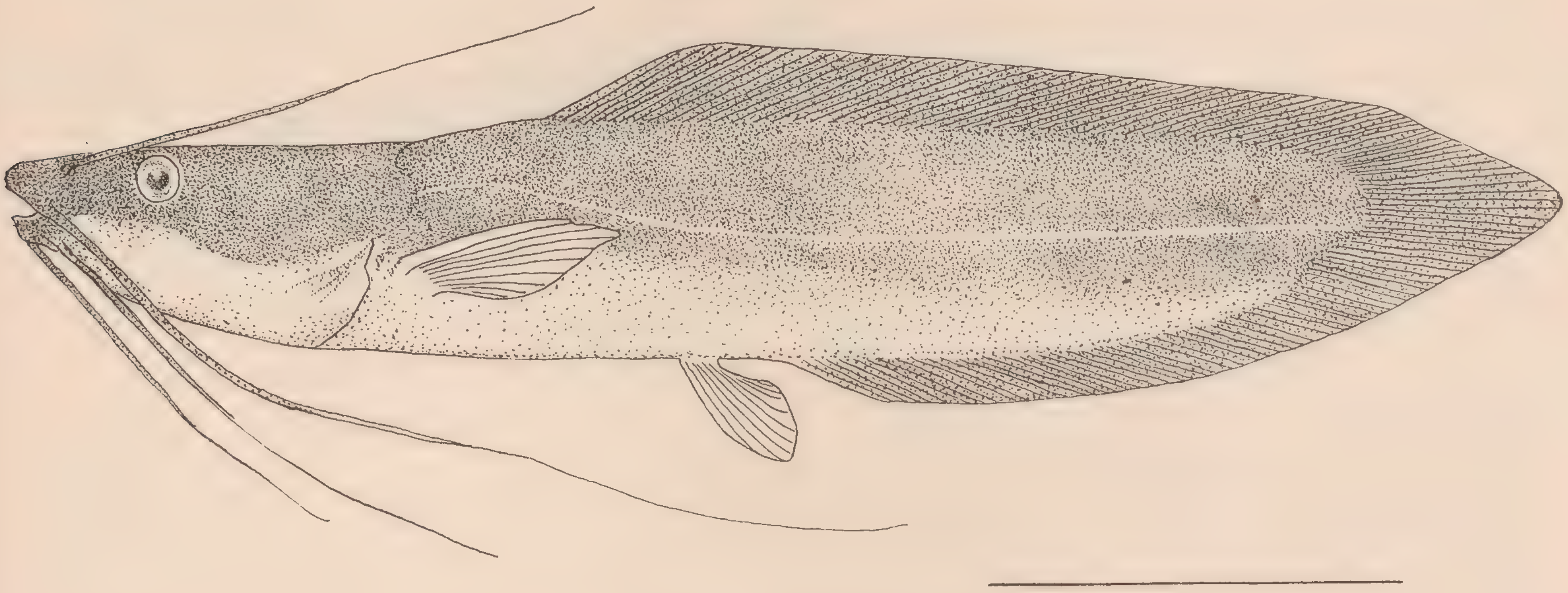


Fig. 18. *Clarias zygouron*, type.

138. **Clarias platycephalus** *Boulenger.*

Several specimens, from about 4 to 15 inches in length, from Niapu and Stanleyville.

139. **Clarias malaris** sp. nov.

Ventral fins midway between end of snout and root of caudal; nasal barbel shorter than head; 67 gill-rakers on anterior arch; maxillary barbel much longer than head; a blackish malar stripe on each side.

The type, No. 6441, American Museum of Natural History, from Stanleyville, April 1915, measures 293 mm. in length to root of caudal; depth of body $6\frac{1}{5}$ times in this measure, length of head (to end of occipital process) $3\frac{1}{3}$ times. Head $1\frac{3}{5}$ times as long as broad, its upper surface granulate; occipital process angular; frontal fontanelle elliptical, somewhat sole-shaped, 5 times as long as narrowest breadth, 4 times in length of head; occipital fontanelle small, in advance of occipital process; eye $3\frac{1}{2}$ times in length of snout, 6 times in interorbital width; width of mouth nearly equal to interorbital width; band of premaxillary teeth 5 times as long as broad; vomerine teeth sub-granular, forming a crescentic, continuous band which is broader than premaxillary band; nasal barbel $\frac{6}{11}$ length of head, not quite reaching gill opening; maxillary barbel $1\frac{1}{3}$ length of head, extending beyond tip of pectoral fin; outer mandibular barbel nearly twice length of inner which measures $\frac{5}{7}$ length of head. Gill-rakers rather short, 67 on anterior arch. Dorsal 68, its distance from occipital process $\frac{1}{5}$ length of head, its distance from caudal $1\frac{1}{4}$ times diameter of eye. Anal 50, narrowly separated from caudal. Pectoral $\frac{4}{9}$ length of head, the spine feebly serrated on the outer border and $\frac{2}{3}$ the length of the fin. Ventrals slightly nearer end of snout than root of caudal. Caudal $\frac{1}{2}$ length of head. Upper parts dark, lower parts pale, sharply differentiated on the head; a black malar stripe on each side, starting below the eye and extending to the end of the gill-cover, separated by a broad pale stripe from the dark of the top of the head; caudal and anal light basally, dark terminally; dorsal dark; pectorals and ventrals light, the former tipped with dusky.

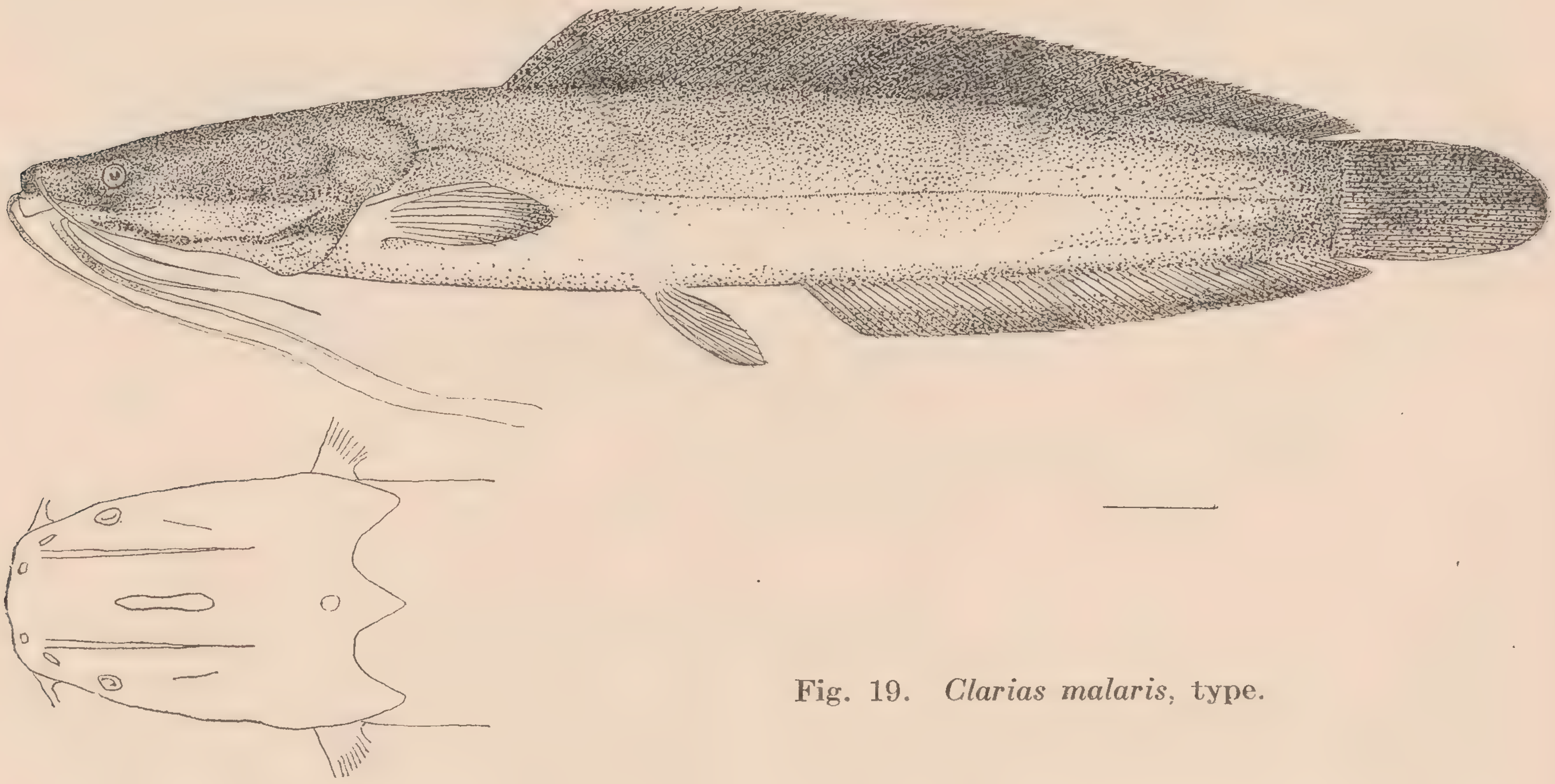


Fig. 19. *Clarias malaris*, type.

Besides the type we have 5 other specimens of this distinctively colored *Clarias* from Stanleyville, February 1915.

140. **Clarias submarginatus** *Peters.*

One specimen 10 inches long from Faradje.

141. **Clarias breviceps** *Boulenger.*

One specimen a foot or more long from Stanleyville.

142. **Clarias angolensis** *Steindachner.*

Several specimens, 1 to about 10 inches long, from Avakubi, Faradje, Medje, Niangara and Stanleyville.

143. **Clarias bythipogon** *Sauvage.*

Several specimens, 2 inches to 1 foot in length, from Avakubi, Faradje, Malela, Niapu, Poko, Rungu, Stanleyville and Zambi. A sketch by Mr. Chapin of one 6 inches in total length from Avakubi shows the following colors: Dark purplish gray, cheeks, paired fins, lower surfaces, margin of dorsal, base of anal, center of caudal, and ill defined band across peduncle dull yellowish. Two longitudinal areas on side of head dusky. Sides and dorsal obscurely mottled with dusky and finely speckled with white.

We have classified our *Clarias* by Boulenger's Key into the species listed above. On account of the considerable individual variation and the often obscure specific characters we are not satisfied with this classification of our material, but are at a loss to substitute a better one. The two species which we have described as new are the best marked that the material under consideration affords.

"Fishes of the genus *Clarias* are common in swampy places, small brooks and muddy pools, rather than open river stretches. Usually caught by damming off pools under the banks, and bailing them out with large leaves. They are among the best food fish of the Congo."

144. **Channallabes apus** (*Günther*).

Numerous specimens, from about 4 to 16 inches in length, from Malela, Niapu, Poko, Rungu, Stanleyville and Zambi. Found in much the same localities as *Clarias.*

145. **Heterobranchus longifilis** *Cuvier & Valenciennes.*

Plate LXX, Fig. 2; Plate LXXVI, Fig. 1.

Five specimens, 5 inches to 1 foot in length, from Stanleyville, also two larger ones from which photographs, skeleton and accessory respiratory organs were preserved.

"Caught on set-lines baited with balls of manioc. A logy, inert sort of fish, which is very good eating."

146. **Eutropius congensis** (*Leach*).

Our specimens range from about 6 to 10 inches in length. Several are from Stanleyville, two from Faradje and two from Boma.

147. **Eutropius niloticus** (*Rüppell*).

We have a dozen specimens, about 6 inches to a foot in length, from Avakubi, Faradje and Stanleyville which are referable to this species rather than to *grenfelli;* probably the one merges into the other.

A color sketch by Mr. Chapin shows a uniform olive-green fish, darker on the back whitish on the belly. His notes say: "The skin of the body, though soft, has a silvery luster, but is covered all over with yellowish slime."

148. **Eutropius grenfelli** *Boulenger*.

Numerous specimens, from about 4 inches to over a foot in length, from Avakubi, Faradje, Niapu, Rungu and Stanleyville. The number of anal rays is very variable, going as low as 44, several specimens having between that number and as high as 50.

"Fishes of the genus *Eutropius* are generally distributed throughout the river and forest streams, sometimes occurring in very large schools."

149. **Eutropius liberiensis** *Hubrecht*.

Nine specimens, from about 4 inches to a foot in length, from Boma we refer to this species. They have the anal count 45 to 50, the nasal barbel from the length of the eye to much longer, $\frac{1}{3}$ that of the head.

150. **Eutropius debauwi** *Boulenger*.

Four small specimens, 2 or 3 inches long, from Avakubi, Niapu and Poko.

151. **Eutropius gastratus** sp. nov.

Lower jaw extending forward quite as far as the snout; base of dorsal partly in advance of base of ventrals; spine of dorsal not longer than head; pectoral not reaching anal; maxillary barbel longer than outer mandibular; nasal barbel longer than eye; anal 53; depth of body $2\frac{3}{4}$ times in length to base of caudal.

The type, No. 6404, American Museum of Natural History, from Rungu, June 1913, measures 320 mm. in length to base of caudal. Depth of body $2\frac{3}{4}$ times in this measure; length of head $4\frac{4}{5}$ times. Head $1\frac{1}{5}$ times as long as broad; snout broad, not projecting beyond lower jaw, 2 times as long as eye; eye perfectly lateral, 6 times in length of head, 4 times in interorbital width; width of mouth almost equalling interorbital width; vomero-palatine teeth forming an uninterrupted band, as broad as the band of premaxillary teeth. Nasal barbel $1\frac{1}{2}$ times as long as eye; maxillary barbel $\frac{3}{5}$ length of head; inner mandibular $\frac{1}{2}$ length of outer, which is a little shorter than maxillary barbel. Gill-rakers moderately long, widely set, 8 on lower part of anterior arch. Dorsal I 6, partly in advance of ventrals, originating $1\frac{3}{4}$ times as far from root of caudal as from end of snout; its spine slender, very feebly serrated behind, about $\frac{3}{4}$ length of head. Anal 53, 4 anterior rays simple, the following gradually decreasing in length. Pectoral not reaching origin of anal, its spine serrated on inner side, as long as head. Caudal forked, with pointed lobes. Caudal peduncle not quite as long as deep. Dull silvery or light bluish gray; back, head and large area on sides between dorsal and pectoral fins dark brownish olive; a dark humeral blotch; fins light, except caudal, which is dark basally.

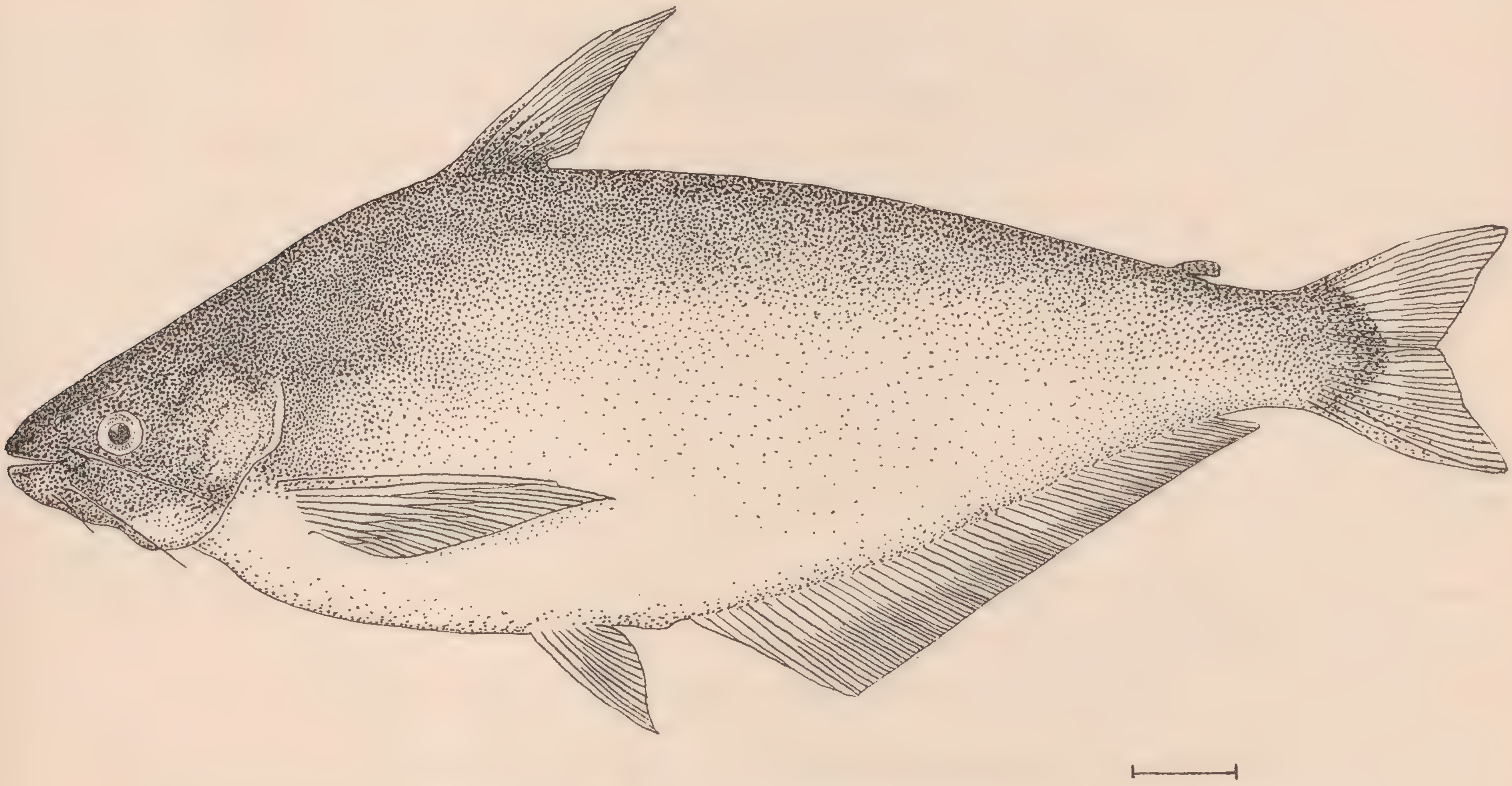


Fig. 20. *Eutropius gastratus*, type.

Besides the type we have two other specimens, 11 and 13 inches respectively, from Faradje, collected in March and December, 1912. Their color is a uniform brownish, darker on the back. The species is readily distinguished from all other members of the genus by its great depth of body. Another specimen colored like the type measures 15 inches, from Stanleyville, February 1915.

152. **Schilbe mystus** (*Linnæus*).

Numerous specimens, about 2 to 8 inches in length, from Stanleyville and one each from Coquilhatville, Faradje and Zambi. Although referable to *mystus* they have the profile in most cases as described for *uranoscopus*.

153. **Schilbe congolensis** *Steindachner.*

Ten specimens, from about 4 to 7 inches in length, from Avakubi, Niangara, Niapu, Poko, Rungu and near Bolobo. The Rungu specimen of about 5½ inches was freckled all over with dark gray, with yellowish and silvery tints on the sides. Head dark brown, also spotted. Iris dark gray.

154. **Ansorgia vittata** *Boulenger.*

A single specimen, 3½ inches long, from Poko.

155. **Parailia longifilis** *Boulenger.*

A single specimen, 2 inches long, from Stanleyville.

156. **Bagrus ubangensis** *Boulenger.*

Several specimens, from about 3 to 14 inches in length, from Avakubi, Faradje and Stanleyville.

157. **Chrysichthys acutirostris** *Günther.*

A single specimen, 6 inches long, from Boma. Though described from Angola it is not surprising to find this species in the lower Congo.

158. **Chrysichthys furcatus** *Günther.*

A dozen specimens, about 8 to 14 inches long, from Boma.

159. **Chrysichthys brevibarbis** (*Boulenger*).

Two large ones about 2 feet long and a small one of 4 inches from Stanleyville. One of about 22 inches without specific data has the maxillary barbel only $\frac{2}{3}$ head and the caudal lobes too short (these may have been broken off).

"Fish of the genus *Chrysichthys* are among the best food-fishes in the Congo. Some of them reach a large size. They are usually taken on set lines and hooks baited with balls of manioc, sometimes captured with poison. They are often caught in the rapids or stony stretches of the river. They are probably quite omnivorous and are noted for their fondness for human excrement."

160. **Chrysichthys longibarbis** (*Boulenger*).

Two about a foot long from Stanleyville.

161. **Chrysichthys duttoni** *Boulenger*.

One 10 inches long from Stanleyville.

162. **Chrysichthys wagenaari** *Boulenger*.

Plate LXXVII, Fig. 2.

Two about 12 to 16 inches long from Avakubi and Poko.

163. **Chrysichthys cranchii** (*Leach*).

Specimens are from about 3 to 18 inches long, several from Stanleyville and Boma, two from Zambi.

164. **Chrysichthys punctatus** *Boulenger*.

Specimens are from about 4 to 14 inches long, several from Stanleyville, three from Avakubi.

165. **Chrysichthys delhezi** *Boulenger*.

Ten specimens, from about 5 inches to a foot in length, from Avakubi, Faradje, Poko and Stanleyville.

166. **Chrysichthys ornatus** *Boulenger*.

A dozen specimens, from about 1½ to 7 inches in length, from Malela, Niapu, Rungu and Stanleyville.

167. **Chrysichthys thonneri** *Steindachner*.

Five specimens, about 5 to 9 inches in length, from Poko, Rungu and Stanleyville.

Gnathobagrus gen. nov.

Close to *Chrysichthys*, but head remarkably depressed and strongly striated; lower jaw strongly projecting, so as to expose almost its entire band of villiform teeth.

168. **Gnathobagrus depressus** sp. nov.

The type, No. 6647, American Museum of Natural History, from Boma, June 14, 1915, measures 195 mm. in length to root of caudal; depth $5\frac{1}{5}$ times in this measure; head 3 times. Body cylindrical, flattened below from nape to ventrals, compressed posteriorly. Head strongly depressed, rugose and striated, the upper profile concave in front of the eye, $1\frac{1}{3}$ times as long as broad; occipital process rather narrow, united with the small interneural shield; snout broad and depressed, $\frac{4}{11}$ length of head, the lower jaw strongly projecting, the projecting part nearly $\frac{1}{3}$ length of snout; eye 5 times in length of head, 2 times in interorbital width; width of mouth a little more than $\frac{1}{2}$ length of head, greatly exceeding interorbital width; premaxillary band of teeth almost straight, 6 times as long as broad; vomero-pterygoid teeth forming a long, narrow, crescentic band, discontinuous in the middle; nasal barbel very slender, nearly equalling diameter of eye; maxillary barbel equalling length of head; outer mandibular barbel twice as long as inner and $\frac{2}{3}$ length of head. Gill-rakers rather short and stout, 12 on lower part of anterior arch. Dorsal I 6, rather small, originating nearer snout than root of caudal; spine strong, very feebly serrated on inner side and at tip on outer side, $\frac{1}{2}$ length of head; first soft ray longest, $\frac{3}{5}$ length of head. Adipose dorsal $2\frac{1}{2}$ times as long as deep, its base shorter than that of the rayed dorsal, from which it is separated by a space equal to 2 times its base. Anal 11, 8 rays branched. Pectoral spine $\frac{1}{2}$ length of head very feebly serrated on outer side, strongly on inner side. Caudal deeply forked with rounded lobes, longest rays twice length of median. Caudal peduncle $1\frac{1}{2}$ times as long as deep. General ground color dark olive brown above, becoming light below, irregularly speckled, spotted and clouded with blackish and buffy; a large blackish spot on the gill-cover; caudal fin with a large dark spot on each lobe; other fins light.

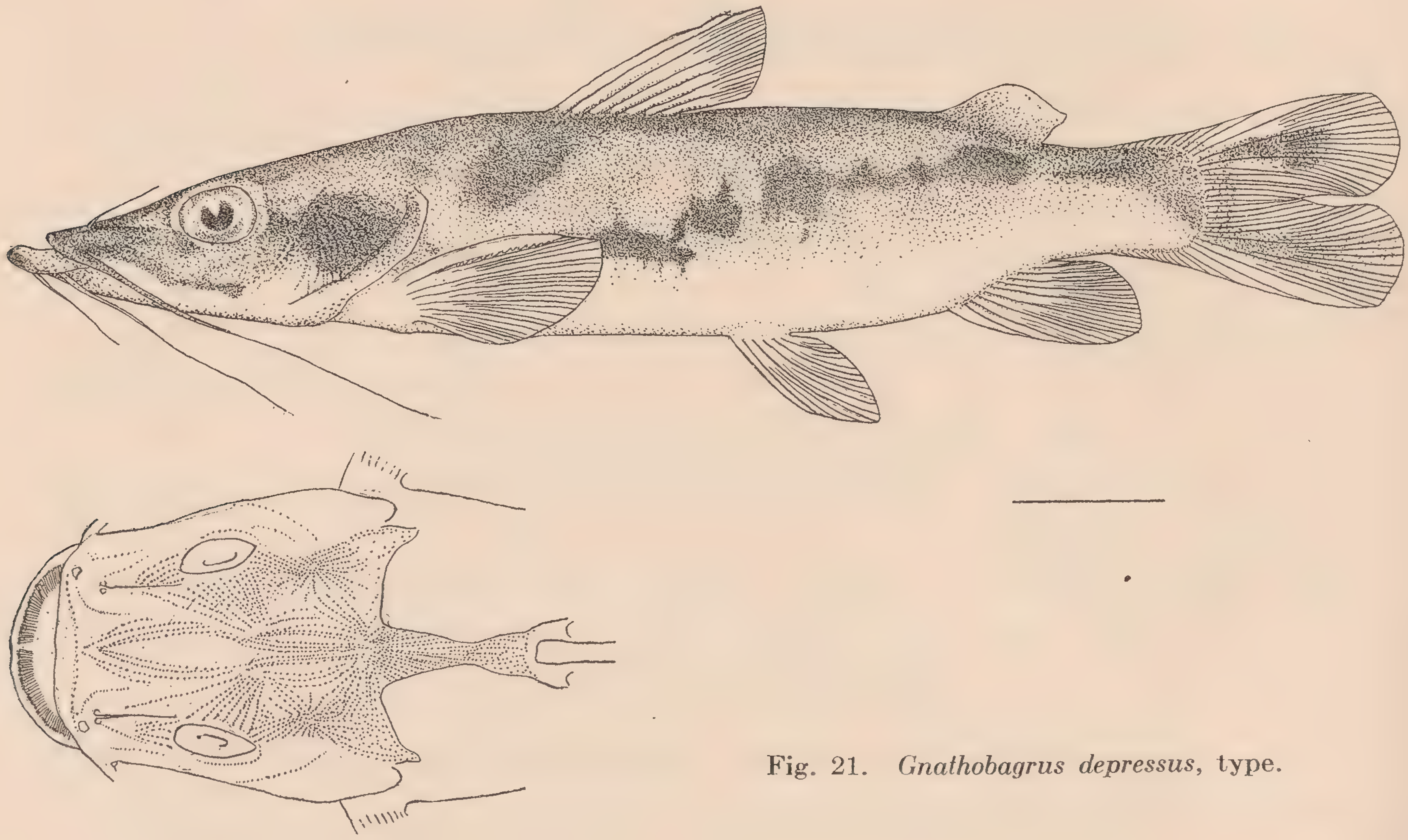


Fig. 21. *Gnathobagrus depressus*, type.

Besides the type we have another specimen of the same size, taken in the same locality a day later.

Amarginops gen. nov.

Body elongate and strongly depressed, broader than deep except posteriorly from anal region, the peduncle strongly compressed. Dorsal and anal fins short, the former consisting of a spine and 6 soft rays, widely separated by the elongation of the posterior body from a very small adipose fin. Pectoral fin with a spine. Ventral fin with 6 soft rays inserted behind the vertical of the dorsal fin. Caudal fin very slightly emarginate, almost truncate. Body and fins covered with thin, lax skin, which also extends across the eye. Four pairs of barbels. Head flat, the eyes superior. Lower jaw strongly projecting, exposing most of its teeth. Nostrils well separated from each other. Jaws with a band of villiform teeth. Two narrow crescentic bands of teeth in the roof of the mouth separated by a narrow space. Gill-membranes free, deeply notched.

This remarkable aberrant genus is most closely related to *Chrysichthys* and *Gnathobagrus*. The latter in regard to its depressed head and projecting lower jaw may be regarded as a specialized *Chrysichthys*. *Amarginops*, a more specialized or degenerate form, has less pronounced affinities with *Chrysichthys*. The depressed, flat body, the lax skin even covering the eyes, and the subtruncate caudal may very well be degenerations due to long residence in the mud at the bottom of the rivers where it occurs. It is unfortunate that we have no notes on the habits of this interesting fish. Mr. Lang tells us that 8 or 9 of them were caught by natives in a trap in a backwater of the Congo.

169. **Amarginops platus** sp. nov.

The type, No. 6528, American Museum of Natural History, from Stanleyville, February 1915, is 170 mm. in length to base of caudal; depth 9¾ times in this measure, length of head 3½ times. Head depressed, almost flat 1¼ times as long as broad, its greatest depth less than ⅓ its length, almost smooth above; occipital process narrow, narrowly separated from the small interneural shield; a small round bony projection above the humeral process on each side; snout broad and flat, ⅓ length of head, the lower jaw strongly projecting; eye covered with skin, 9 times in length of head, 3 times in interorbital width; width of mouth more than ½ length of head, nearly twice the interorbital width; premaxillary band of teeth almost straight, 5 times as long as broad; nasal barbel equalling diameter of eye; maxillary barbel less than half length of head; outer mandibular barbel nearly twice length of inner and equalling maxillary barbel in length; a big fold of loose skin at each corner of the mouth, permitting it to lie very widely opened. Gill-rakers long, slender and closely set, 12 on lower part of anterior arch. Dorsal I 6, rather small, originating twice as far from root of caudal as from end of snout; spine small, blunt and rather stout, not serrated, a little more than ¼ length of head; fourth soft ray longest, nearly ½ length of head.

Adipose dorsal very small, about as long as deep, just equal to eye, originating over first anal rays, its base only $\frac{1}{3}$ that of rayed dorsal from which it is separated by a space equal to 11 times its base. Anal 12. Pectoral spine small, stout and curved, strongly serrated on inner side, a little more than $\frac{1}{3}$ length of head. Caudal slightly emarginate, sub-truncate. Caudal peduncle twice as long as deep. Olive brown or gray above, whitish beneath.

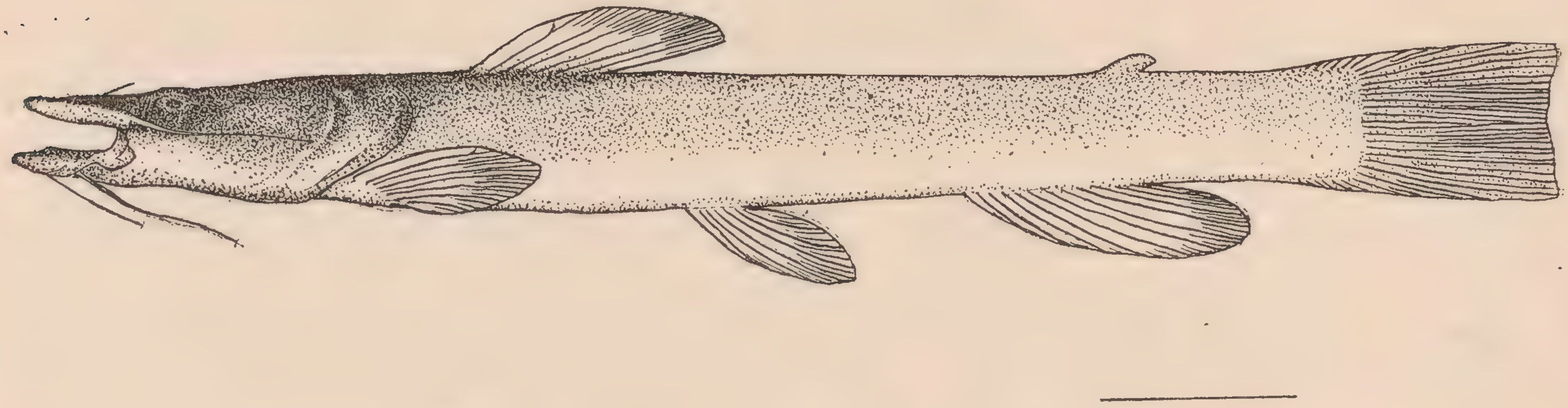


Fig. 22. *Amarginops platus*, type. Lateral view.

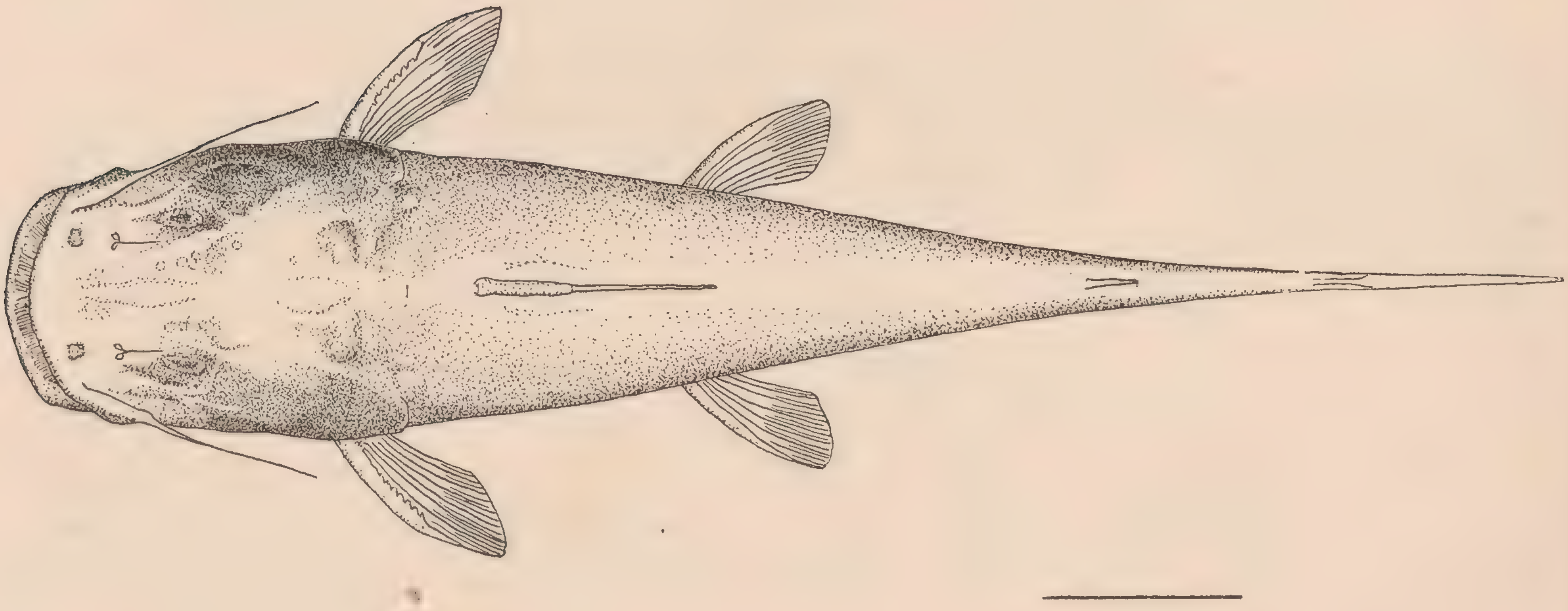


Fig. 23. *Amarginops platus*, type. Dorsal view.

Besides the type we have another specimen of the same size and with the same data.

170. **Gephyroglanis congicus** *Boulenger.*

A half dozen large specimens between 1 and 2 feet in length from Stanleyville, caught in the rapids or stony stretches of the river. A good food fish.

171. **Gephyroglanis longipinnis** *Boulenger.*

A dozen small specimens about 1 to 5 inches in length and one larger one of 14 inches from Stanleyville, one small one each from Avakubi and Faradje.

172. **Amphilius notatus** sp. nov.

The type, No. 6711, American Museum of Natural History, from Faradje, January 1913, measures 30 mm. in length to base of caudal, depth $6\frac{1}{2}$ times in this measure, head $4\frac{1}{2}$ times. Head $1\frac{1}{2}$ times as long as broad; snout obtusely pointed, $\frac{1}{2}$ length of head; eye without a free border, $5\frac{1}{2}$ times in length of head, its diameter about equal to interorbital width; posterior nostril more distant from anterior nostril than from eye; barbels all slender and simple; maxillary barbel about $\frac{1}{2}$ length of head, outer mandibular $\frac{2}{3}$. Gill-membranes narrowly attached to the isthmus. Dorsal 7, much nearer end of snout than root of caudal. Second dorsal large, with distinct rays, 4 times as long as deep, about $1\frac{1}{2}$ times as long as its distance from first dorsal, and twice the base of that fin. Anal 9. Pectoral $\frac{3}{4}$ length of head, without a spine. Ventral $\frac{3}{5}$ length of head, below center of first dorsal. Caudal with crescentic notch. Caudal peduncle from axil of anal $3\frac{1}{2}$ times as long as deep. A large black blotch between margin of gill-cover and front of first dorsal; another from front of second dorsal to middle of side; a third on upper base of caudal; two smaller spots on the back intermediate between these three.

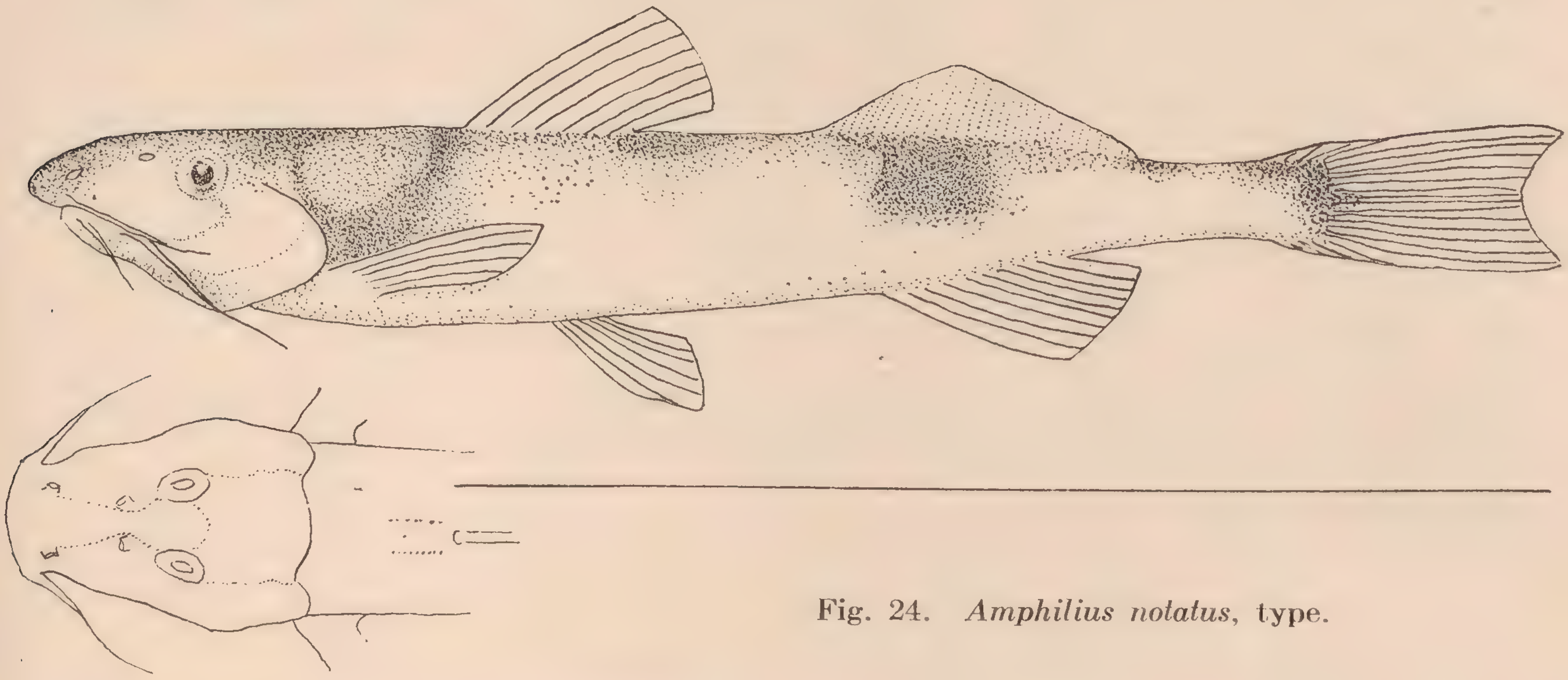


Fig. 24. *Amphilius notatus*, type.

Apparently close to *A. angustifrons* Blgr., but adipose fin rayed, gill-membranes narrowly attached to the isthmus, and posterior nostril rather near eye. These characters would ordinarily be of generic significance, but our little fish has so close a resemblance to *A. angustifrons* that we prefer to place it in *Amphilius*.

173. **Auchenoglanis occidentalis** (*Cuvier & Valenciennes*).

Plate LXXV, Fig. 3.

Numerous specimens, from about 1 inch to 2 feet in length, from Avakubi, Faradje, Stanleyville and Boma. One from Faradje had the following colors: Dark brownish green above, separated into blotches on sides by pale creamy reticulations; dorsal dark greenish brown with pale reticulation; breast bluish white; a pale brown ring about the dark brown iris. This species is notable for its wide range.

174. **Auchenoglanis ballayi** (*Sauvage*).

Several specimens, from about 1 inch to 1 foot in length, from Avakubi, Bafwabaka, Faradje, Niapu, Rungu and Stanleyville. One from Rungu had the following colors: Dark blue gray above, paler on lower sides, and whitish on ventral surface; back and sides covered with a dull yellowish slime which gives the live fish a greenish gray color; 7 rows of black spots. Two of about 9 inches from Faradje were: Above pale yellowish brown with dark spots, some purplish, on sides; and dark greenish brown, whitish below, with pale reddish brown towards the anal fin, 7 rows of black dots running transversely, besides a few black dots behind the skull.

175. **Arius africanus** (*Günther*).

One specimen, about 14 inches long, from Stanleyville. This specimen from the Congo fits very well the description of *africanus*, from East Africa, except that the patches of pterygoid teeth are somewhat broader than figured by Boulenger, the pectoral spine longer than the dorsal spine, and both perhaps more strongly serrate. Very likely the Congo fish is separable as a geographic race, but we have not sufficient material to determine this satisfactorily. It is at least very close to *africanus*.

176. **Synodontis acanthomias** *Boulenger*.

Numerous specimens, about 5 inches to 1½ feet long, from Avakubi, Faradje, Rungu and Stanleyville. One from Rungu was dark greenish gray above with numerous dark blue-gray spots; yellowish on the sides and below. In life the body and spines of the head have a heavy jelly-like coating which gives a greenish gray color. Beneath this, the color is yellowish. Common in rocky parts of the river at Stanleyville.

177. **Synodontis afro-fischeri** *Hilgendorf*.

Five specimens, about 3 to 9 inches in length, from Faradje, Rungu, and Stanleyville, agree with this species described from Lake Victoria.

178. **Synodontis depauwi** *Boulenger.*

Several specimens, about 1 to 7 inches long, from Avakubi, Bafwabaka, Faradje, Niapu, Rungu and Stanleyville. One about 6 inches long, from Faradje, kept alive in a dish of water, remained close to the bottom and its barbels were kept in constant motion. Others similarly confined in a tank came to the surface; they held the maxillary barbels either at right angles to the body or backward, the longer mandibular barbels extending horizontally forward, and the shorter hanging down. There were tadpoles in the tank with them, and some of these were sucked in by the catfish. The natives catch them with pieces of worms. When taken in the hand they at once set their pectoral spines firmly.

179. **Synodontis angelicus** *Schilthuis.*

Two specimens, 6 or 8 inches long, from Stanleyville, taken in the rapids.

180. **Synodontis soloni** *Boulenger.*

Three specimens, 5 or 6 inches long, from Stanleyville.

181. **Synodontis longirostris** *Boulenger.*

Several specimens, 6 inches to 2 feet in length, from Stanleyville. One a foot long has the snout and lips remarkably spongy and expanded, the fleshy part projecting at least an inch beyond the mouth, and at first sight was thought to be a distinct species or even genus. Its agreement with *longirostris* in other respects, however, and the fact that a 2 foot specimen shows an intermediate condition convince us that it is the same.

182. **Synodontis tenuis** sp. nov.

Humeral process pointed, without spines; spinous dorsal not serrated in front; maxillary barbel ¾ length of head; snout much longer than postocular part of head; movable mandibular teeth 15; depth 5½.

The type, the only specimen, No. 6535, American Museum of Natural History, from Stanleyville, measures 102 mm. in length to base of caudal; depth 5½ in this measure, head 3¾. Head 1⅖ times as long as broad, rugose above from between the eyes; snout obtusely pointed, twice as long as postocular part of head; eye superolateral, 3 times in length of head, slightly greater than interorbital width; lips moderately developed; premaxillary teeth forming a short broad band; movable mandibular teeth about ¼ diameter of eye, 15 in number. Maxillary barbel weakly margined,

$\frac{3}{4}$ length of head, reaching root of pectoral spine; outer mandibular barbel not quite twice as long as inner; both with short and mostly bifid branches. Gill opening not extending downwards beyond root of pectoral spine. Occipito-nuchal rough like the occiput, convex or bluntly angled, longer than broad, with bluntly pointed posterior processes; humeral process rugose, with a slight keel, much longer than broad, pointed, not extending as far back as occipito-nuchal process. Dorsal I 7; spine feebly curved, about $\frac{3}{4}$ length of head, striated, smooth in front, with a few serrations behind. Adipose dorsal 6 times as long as deep, twice as long as its distance from rayed dorsal. Anal III 9; pectoral spine slightly longer than dorsal, very strongly serrated on both sides. Ventral not reaching anal. Caudal very deeply forked, with slender pointed lobes, the upper the longer. Caudal peduncle $1\frac{1}{2}$ times as long as deep. Irregularly blotched; caudal faintly spotted with blackish.

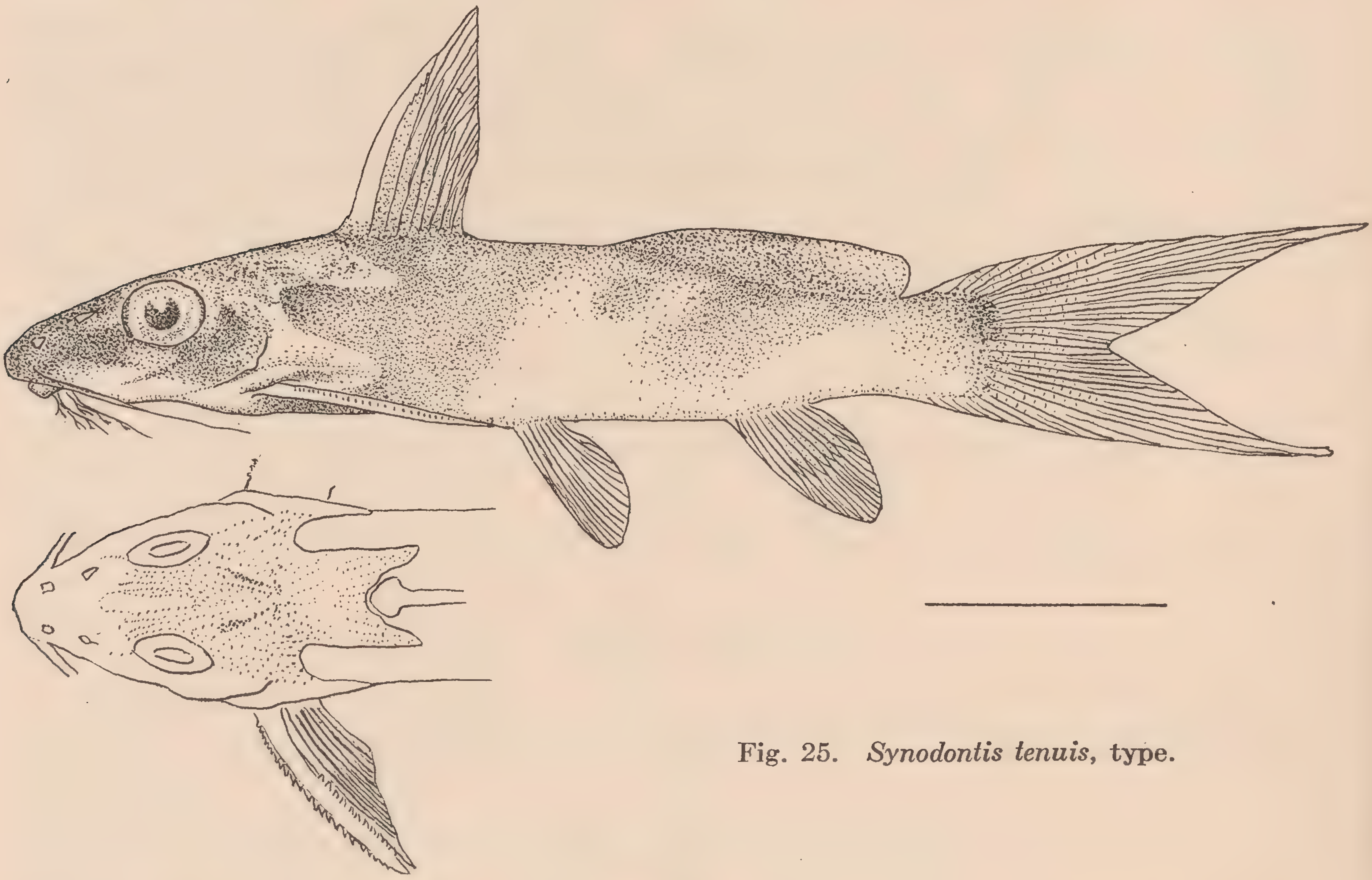


Fig. 25. *Synodontis tenuis*, type.

This is a very slender species, suggesting the young of *S. acanthomias* and *longirostris*, from which various points of difference separate it.

183. **Synodontis greshoffi** *Schilthuis.*

Several specimens, about 3 to 6 inches in length, from Avakubi, Faradje, Rungu and Stanleyville.

184. **Synodontis alberti** *Schilthuis.*

Specimens are about $2\frac{1}{2}$ to 6 inches long; several from Stanleyville, one from Coquilhatville. Those from Stanleyville were taken in the rapids.

185. **Synodontis notatus** *Vaillant.*

Specimens 1½ to 3½ inches in length from Stanleyville (4), and one from Coquilhatville; they have the humeral process bluntly pointed instead of rounded behind; they are obviously young, however, and in other respects match the description of *notatus* so exactly that we prefer to refer them to this species rather than to describe them as new.

186. **Synodontis pleurops** *Boulenger.*

Plate LXXVI, Fig. 2.

Several specimens, about 1 to 8 inches in length, from Avakubi, Faradje, Poko, Rungu and Stanleyville. In color they are dark with vermiform lighter marking on the sides; this is different from the color given for *pleurops,* but in other respects they agree so well with that species that we have no hesitation in referring them to it. Young (2½ inches) are quite different in appearance from the adult. They have the humeral process bluntly pointed with a feeble keel; caudal fin long and slender; adipose comparatively small; head between the eyes broad and flat. One of about 6 inches from Poko was dusky greenish brown with many irregular yellowish markings. Three to 5 inch specimens from Faradje were caught among the rocks. A color sketch by Mr. Chapin of a 7 inch specimen from Faradje shows a dark olive colored fish, the fins and spots and vermiculations on the sides yellow, the top of the dorsal and a stripe in the center of each caudal lobe dusky.

187. **Synodontis decorus** *Boulenger.*

Plate LXXXI, Fig. 4 (colored).

Several specimens, about 4 to 10 inches in length, from Avakubi, Faradje, Poko and Stanleyville. Most of them have parallel black longitudinal stripes on the sides instead of the spots figured by Boulenger. One about 10 inches long from Poko had the ground color dark pinkish gray. One of the same size from Faradje was grayish above and on the sides, with blue reflections on the back and silvery reflections below, the caudal fin whitish with black markings, bordered with pink.

188. **Microsynodontis batesii** *Boulenger.*

One about 2 inches long from Niapu, taken at low water in a small shady forest river.

189. **Chiloglanis batesii** *Boulenger.*

Several specimens from the "Lower Congo" and two from Faradje, ½ to 1 inch long.

190. **Euchilichthys guentheri** (*Schilthuis*).

Plate LXXIX, Fig. 2.

Several specimens, about 4 inches to 2 feet in length, from Avakubi, Faradje, Panga and Stanleyville. Proportions vary with age, thus a large one 18 inches long has the depth only 5¾ (instead of 7) the eye 11½ in head (instead of 10) 6½ in interocular width (instead of 5) and the adipose fin 5½ times in its distance from the dorsal (instead of 4). Fishes of this genus usually occur in rapids clinging to mossy stones. The larger ones clear smooth snail-like tracks through the moss-like water plants.

191. **Euchilichthys royauxi** *Boulenger.*

Several small specimens, about 1 to 5 inches in length, from Stanleyville and Faradje, and a large one of 18 inches from Stanleyville. The latter has somewhat different proportions, namely depth 4½, eye 10 in head, 5 in interocular.

192. **Euchilichthys dybowskii** (*Vaillant*).

Plate LXXVI, Fig. 3.

Several specimens, about 2 to 4 inches long, from Avakubi, Faradje, Poko and Stanleyville.

We quote from Mr. Chapin's notes concerning the specimens from Avakubi, his colored field sketch of which is published in this paper. "Two examples were brought alive in a basin where they stuck fast to the smooth enamel surface. When thus attached, the water for respiration enters by the back of the mouth, and the movement of the gills often makes the whole fish quiver or move slightly back and forth. Natives say they cling to rocks and eat algæ. They can swim rapidly. The mouth is here drawn as though slightly extended; while sucking it of course contracts. The color is changeable and may become somewhat lighter than the sketch."

Acanthocleithron gen. nov.

Body moderately elongate, slightly compressed; anterior dorsal ending over the ventrals, formed of a strong spine and 7 branched rays; second dorsal fin with very fine soft rays, their bases concealed by adipose tissue. Pectoral fin with a strong spine; ventral with 7 rays. A cephalo-nuchal bony shield. Humeral process short and rounded. A bony projection forming a short, stout, sharp, backwardly directed spine just above and anterior to the base of the pectoral spine. Mouth subinferior, small, without labial folds; small conical teeth in both jaws, none on the palate. A maxillary and 2 mandibular barbels on each side, the latter with slender branches. Nostrils remote from each other, each with a valve, the posterior larger; eye moderate, with a free border. Gill-openings rather large, the membrane narrowly attached to the isthmus.

This genus is most closely related to *Mochocus* from which it differs in the following important particulars: (1) The spinous projection above the base of the pectoral spine. (2) The eye with a free border. (3) The greater slenderness of the adipose rays and their bases covered with adipose tissue. (4) The short rounded humeral process. Other characters of minor importance which distinguish it from the two known species of *Mochocus* are the shorter maxillary barbel and the much longer adipose fin. The coloration and general habitus are remarkably like *M. brevis*. So far, known only from Avakubi, Upper Congo.

193. **Acanthocleithron chapini** sp. nov.

The type, No. 6548, American Museum of Natural History, from Avakubi, August 1913, measures 55 mm. in length to base of caudal. Depth of body 6 times in this measure, head $4\frac{1}{3}$ times. Head depressed, but little longer than broad; eye supero-lateral, with a free border, 4 times in length of head, $1\frac{1}{2}$ times in interorbital width. Barbels moderately long and slender, maxillary slightly longer than head; mandibular barbels shorter with slender simple branches. Occipito-nuchal shield longer than broad, with very short posterior processes. A short, rounded humeral process. Anterior dorsal I 7, much nearer end of snout than root of caudal; spine $\frac{2}{3}$ length of head, not serrated; second dorsal with numerous fine rays, its base 5 times

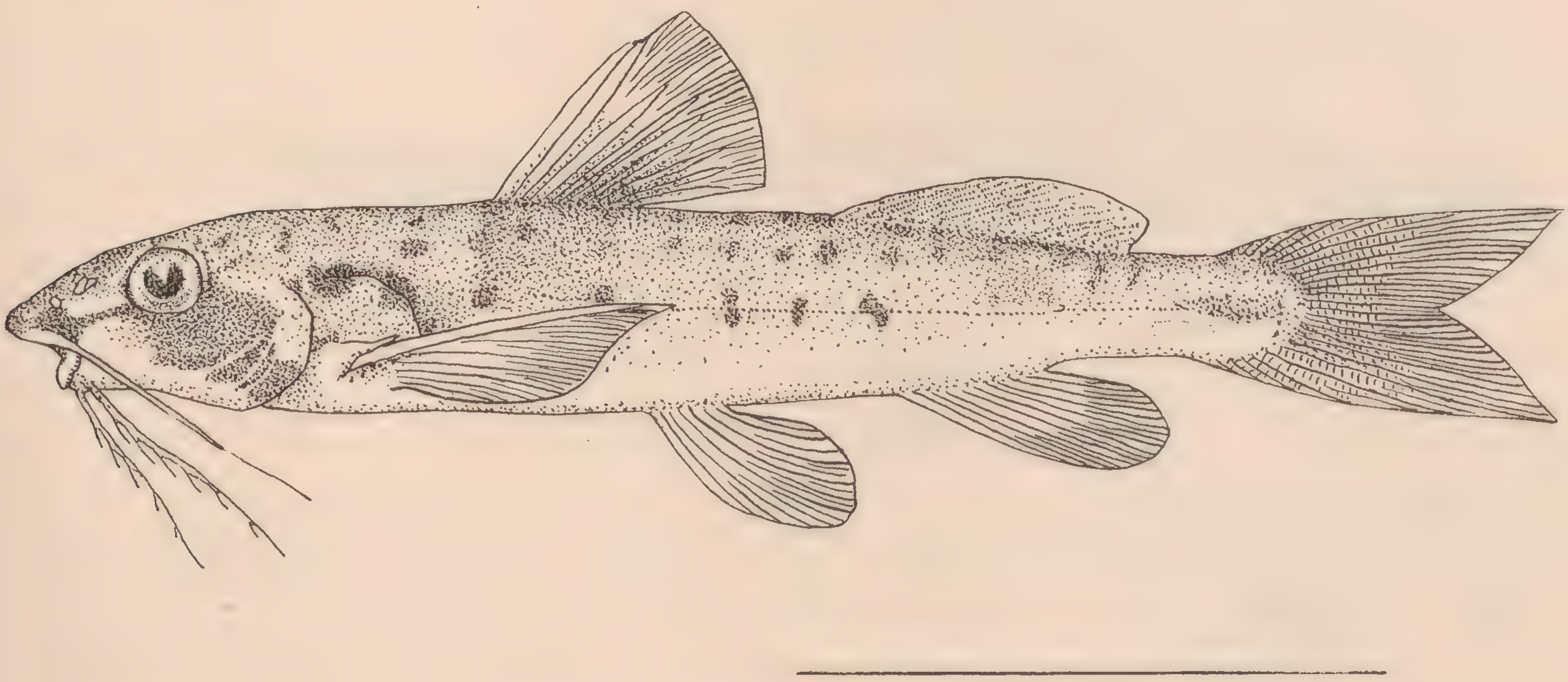


Fig. 26. *Acanthocleithron chapini*, type.

as long as high, much greater than base of first dorsal, $1\frac{1}{2}$ times as long as its distance from the first dorsal. Anal 10. Pectoral spine longer than dorsal spine, as long as head, entire on outer border, very strongly serrated on inner border, reaching base of ventral. Ventral origin equally distant from end of snout and root of caudal; not reaching anal. Caudal forked, the lobes equal. Caudal peduncle twice as long as deep. Pale yellowish or grayish olive above, lighter below, speckled and marbled with blackish; two more or less regular dark bands across the back, one under each of the dorsal fins, a dark spot on the caudal peduncle, fins yellowish.

Besides the type we have four other specimens of the same size from the same locality, collected in August, September and December, 1913.

We take much pleasure in naming this interesting species for Mr. James P. Chapin.

194. **Doumea typica** *Sauvage.*

One 3 inch specimen without specific data, probably from Faradje or Stanleyville.

195. **Doumea alula** sp. nov.

Head $1\frac{1}{4}$ times as long as broad; snout $1\frac{2}{3}$ times as long as postocular part of head; space between 2 nostrils less than from anterior to end of snout, and much less than distance from posterior nostril to eye; caudal peduncle 3 times as long as deep, only $\frac{1}{5}$ of total length to caudal base.

The type, No. 6531, American Museum of Natural History, from Stanleyville, February 1915, measures 110 mm. in length to base of caudal; depth of body 7 times in this measure; head 5 times; head strongly depressed, with slightly rugose occiput, covered with thin skin, $1\frac{1}{4}$ times as long as broad; snout bluntly pointed, projecting a little beyond mouth, $1\frac{2}{3}$ times as long as postocular part of head; space between the

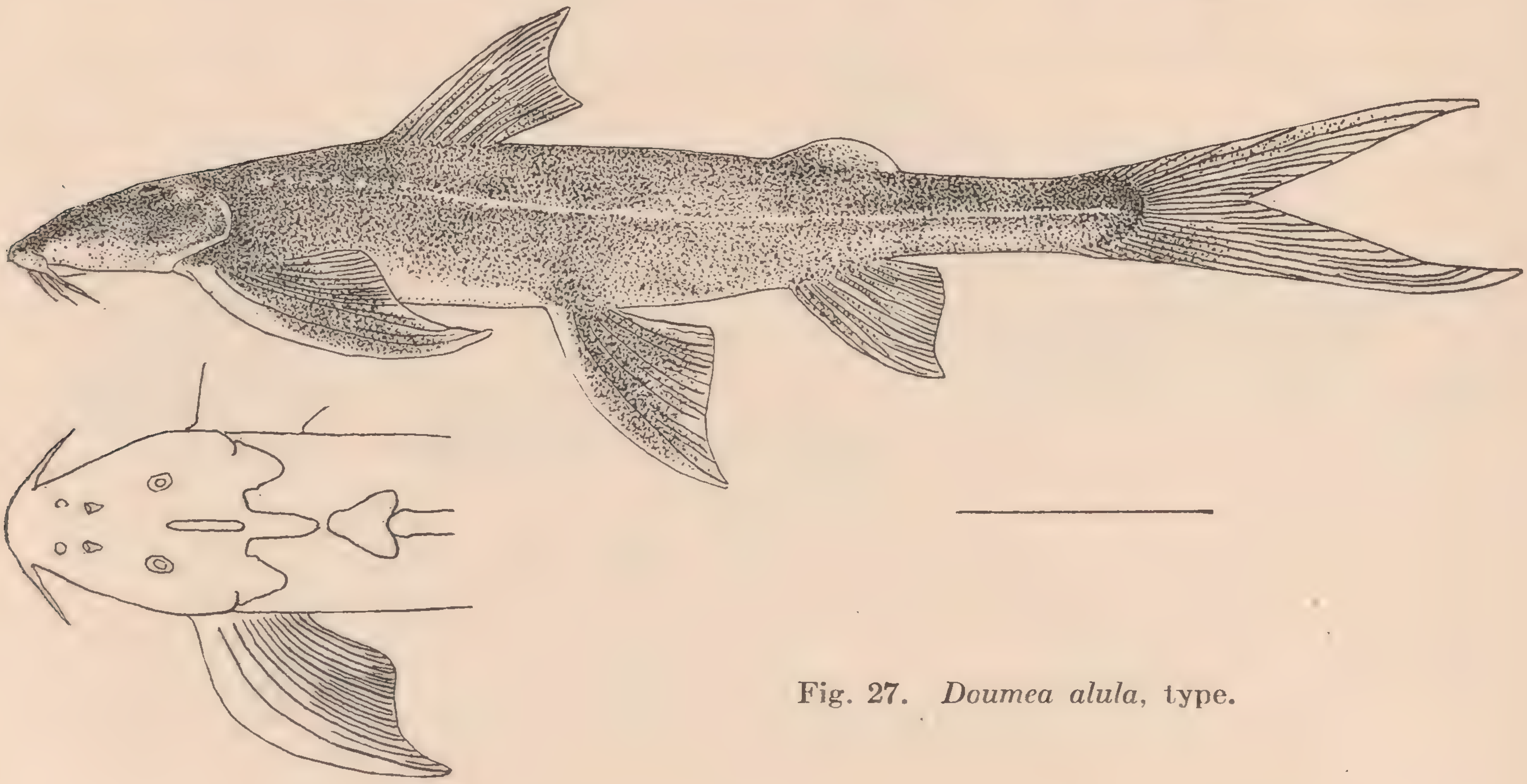


Fig. 27. *Doumea alula*, type.

2 nostrils less than distance from anterior nostril to end of snout, and much less than space between posterior nostril and eye; latter directed upwards, 8 times in length of head, 2 times in interorbital width. Maxillary barbel $\frac{1}{3}$ length of head, mandibular barbels shorter still. Occipital process narrow, nearly 3 times as long as broad, narrowly separated from interneural shield. First dorsal I 6; first ray a little shorter than head; border of fin concave. Anal II 7. Pectoral $1\frac{1}{2}$ times length of head, not reaching ventral; latter $1\frac{1}{7}$ times head, extending beyond origin of anal. Caudal deeply forked, lower lobe the longer, $1\frac{2}{3}$ times head. Caudal peduncle 3 times as long as deep, $\frac{1}{5}$ the total length. Brownish above, lighter beneath; ill-defined yellowish bars across the back, extending down the sides; head much darker; lobes of caudal dark on the outer side; light on the inner; pectoral and ventrals dark above, tipped with whitish, lower surfaces yellowish, with white outer margins and a broad, subterminal dusky bar; dorsal and anal light with an indistinct dusky terminal bar.

Besides the type we have four other specimens as follows:

1	juvenile	$1\frac{1}{2}$	inches,	Lower Congo (exact locality unknown).
1	adult	5	"	Faradje, December 1912.
1	"	6	"	Avakubi, September 13, 1913.
1	young	1	"	Faradje, January 1913.

This species is readily distinguishable from *typica* and *angolensis* by its stouter, shorter peduncle, different head proportions and coloration. Its discovery together with the single *typica* in the collection, greatly extends the range of the genus northward.

196. **Phractura scaphirhynchura** (*Vaillant*).

Several specimens about 3 to 6 inches long from Niapu and Niangara.

197. **Paraphractura tenuicauda** *Boulenger*.

Three specimens, about 4 to 6 inches long, from Stanleyville. Caught near shore with small hooks by native boys close to rocks in swift water.

198. **Belonoglanis tenuis** *Boulenger*.

A half dozen specimens, about 3 to 7 inches long, from Faradje, Niapu and Stanleyville. Those from Faradje were blasted from the muddy Garamba River with tonite.

199. **Malopterurus electricus** (*Gmelin*).

Plate LXXVII, Fig. 1.

A dozen specimens, $2\frac{1}{2}$ inches to a foot in length, from Avakubi, Bafwabaka, Faradje and Stanleyville. Speaking of the use of poison in fishing by the natives at Faradje (Copeia, December 1915) Mr. Lang says: "While we were standing on a rock, a boy had thrown out with a painful yell, a small specimen of an electric catfish (*Malopterurus electricus*). To prevent its struggling back into the water, I stepped on it and was greatly surprised to receive through a one-third inch heavy leather sole, a shock that made me withdraw my foot quickly. I pushed the fish into a hole and Mr. Chapin and myself marveled that such a small specimen could store enough electricity to repeat this performance at least ten times through wet soles.

"Many tribes do not eat this fish, which has a thick, rather loose, blubber-like skin [native men fear that to do so would be detrimental to their virility] but I have heard from white men that it is excellent eating, after the removal of its electric hide."

CYPRINODONTIDÆ.

200. **Haplochilus platysternus** sp. nov.

Dorsal 9; scales 28; dorsal originating above posterior third or fourth of anal; caudal rounded, not longer than head; body very compressed; preventral area swollen in adults; depth of body $2\frac{3}{4}$ in length to base of caudal.

The type, No. 6299, American Museum of Natural History, from Stanleyville, April 1915, is 33 mm. to base of caudal; depth $2\frac{3}{4}$ times in this measure, head 4 times.

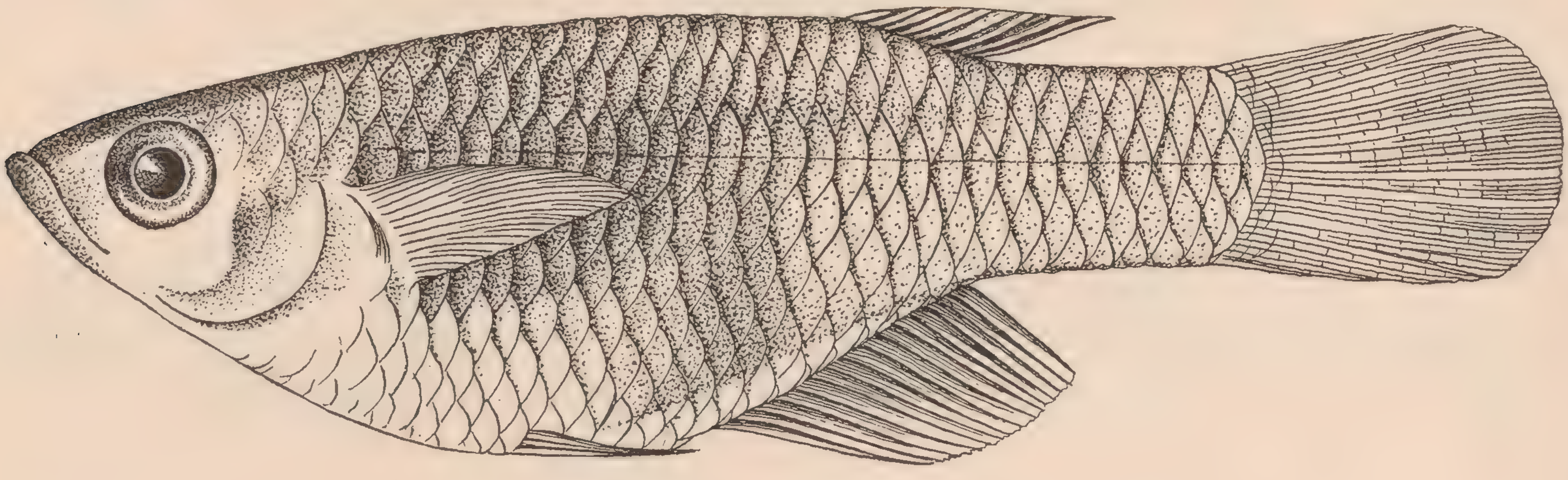


Fig. 28. *Haplochilus platysternus*, type.

Head flat above; body much compressed; preventral area swollen and compressed; snout short and broad, shorter than eye; mouth directed upwards, lower jaw projecting; eye nearly 3 times in head, but little shorter than postocular part of head, $1\frac{1}{3}$ times in interorbital width. Dorsal 9, originating twice as far from snout as from root of caudal, above posterior fourth of anal. Anal 15. Pectoral $\frac{2}{3}$ length of head extending beyond root of ventral; latter very small, much nearer end of snout than root of caudal. Caudal rounded, slightly shorter than head. Caudal peduncle nearly twice as long as deep. Scales 28 in longitudinal series, 20 around the body in front of ventrals; no lateral line pits. Pale yellowish brown, most of the scales with a dark basal bar; a fine blackish line runs along the side of the body posteriorly; a dark cloudy area back of the gill-covers; fins grayish.

Besides the type, we have 38 other specimens, all from Stanleyville, taken in small forest brooks affluent to the Tshopo, collected between February and April 1915, measuring about 20 to 35 mm.

This distinct little *Haplochilus* is remarkable for its great depth anteriorly compared with its slender caudal peduncle, and its very compressed body.

201. **Haplochilus elegans** *Boulenger.*

Several specimens, from ½ to 1½ inches long, from Stanleyville, Faradje and Medje. The single Faradje specimen was taken in a swamp, among water plants.

202. **Haplochilus spilauchen** (*Dumeril*).

A single specimen 2½ inches long from Zambi, taken in grassy swamps bordering the river.

203. **Haplochilus multifasciatus** *Boulenger.*

Several specimens, 1 or 2 inches long, from Stanleyville, taken in pools in a clear running forest river, affluent of the Tshopo.

204. **Haplochilus singa** *Boulenger.*

About a dozen, 1 or 2 inches long, from Stanleyville, taken in the same places as the above.

SERRANIDÆ.

205. **Lates niloticus** (*Linnæus*).

Plate LXXVIII, Fig. 1.

Seven specimens, about 6 to 16 inches long, from Faradje and Stanleyville. By white men this is considered the best food fish of the Congo. Common everywhere in the larger rivers from Faradje to Zambi. Small individuals are seldom seen.

CICHLIDÆ.

206. **Tilapia andersonii** (*Castelnau*).

A single specimen, 2½ inches long, from the Upper Congo.

207. **Tilapia lepidura** *Boulenger.*

Three small specimens, about 2 to 4 inches long, from Malela and Zambi.

208. **Tilapia boulengeri** *Pellegrin.*

Numerous specimens, about 1 to 7 inches in length (mostly under 3 inches), from Stanleyville.

209. **Tilapia dolloi** *Boulenger.*

Nine specimens, about 4 to 6 inches long, from Stanleyville.

210. **Tilapia melanopleura** *Dumeril.*

Plate LXXX, Fig. 1 (colored).

Numerous specimens, about ½ to 10 inches in length, from Avakubi, Coquilhatville, Faradje, Garamba, Poko, Rungu and Stanleyville.

211. **Tilapia tholloni** (*Sauvage*).

Three specimens, about 4 to 6 inches long, from the Lower Congo.

212. **Tilapia christyi** *Boulenger.*

A single specimen, 4 inches long, from Avakubi. It has the dorsal XV 11; anal III 8; caudal peduncle much deeper than long.

213. **Tilapia fasciata** (*Perugia*).

Two specimens 2 or 3 inches long from Zambi.

214. **Tilapia acuticeps** (*Steindachner*).

Seven small specimens, 1 or 2 inches long, from Stanleyville. Evidently a widely distributed species, as the Congo is north of its previously known range.

215. **Tilapia williamsi** (*Günther*).

A single specimen $1\frac{1}{2}$ inches long from Stanleyville. Its dorsal has 17 spines and it has 31 scales. *Tilapia stigmatogenys* is doubtfully distinct from *williamsii.*

216. **Tilapia stormsii** *Boulenger.*

Numerous specimens, about $\frac{1}{2}$ to $3\frac{1}{2}$ inches long, from Stanleyville. They have the caudal truncate or sub-truncate rather than rounded, otherwise agree admirably with the description of this species. When changed from formalin to alcohol they were beautifully marked with golden yellow and a little red and purple. A specimen had back of eye to snout purple, upper iris yellowish-green, lower red. Maxillary, pectoral and sides yellow. Obscure diffuse dusky cross-bands on the sides. Upper edge of caudal and stripes on dorsal yellow. Tips of spines black. In alcohol there is usually a dusky shade from the nape to the snout and maxillary, and an obscure dark band formed by blackish spots from near the opercle to the peduncle, a paler band above it.

217. **Steatocranus gibbiceps** *Boulenger.*

Four specimens, between 1 and 3 inches long, from Stanleyville.

218. **Haplochromis strigigena** (*Pfeffer*).

A single specimen, about 2 inches long, from Stanleyville. This species, previously known from the Nile and East Africa, seems distinct from the following.

219. **Haplochromis desfontainesii** (*Lacépède*).

Haplochromis moffati Castelnau.

Ten specimens, about $1\frac{1}{2}$ to 5 inches long, from Avakubi and Stanleyville; 3 from Stanleyville are referable to *moffati;* three from Stanleyville and 4 from Avakubi to *desfontainesii.* We do not consider the two species distinct.

220. **Paratilapia macrocephala** *Boulenger.*

A single small specimen $1\frac{1}{2}$ inches long from Poko.

221. **Paratilapia longipinnis** sp. nov.

10–12 gill-rakers on lower part of anterior arch; premaxillary processes moderate, not extending to between the orbits; caudal pointed, scaly; ventral, anal and dorsal fins with some of their soft rays exceedingly long and filamentous.

The type, No. 6298, American Museum of Natural History, from Coquilhatville, May 17, 1915, is 111 mm. in length to base of caudal; depth $2\frac{1}{3}$ times in this measure, length of head $2\frac{3}{4}$ times. Head twice as long as broad; snout moderately pointed, with a straight upper profile, as long as broad, shorter than postocular part of head; eye 4 times in length of head, nearly twice in interorbital width; mouth moderately protractile, not extending to below anterior border of eye; premaxillary processes moderate, not extending to between the orbits; teeth forming broad villiform bands, outer teeth larger but very small, about 60 in the upper jaw; 4 series of scales on the cheek. Gill-rakers moderately long, 11 on lower part of anterior arch. Dorsal XIV 11; spines increasing in length to the last, which measures $\frac{1}{2}$ length of head; middle soft rays very much produced, filamentous, reaching end of caudal. Anal III 9, the third spine shorter but stouter than last dorsal spine; middle soft rays very much produced, filamentous, reaching end of caudal. Pectoral $\frac{2}{3}$ length of head, not extending to vertical of origin of anal. Ventral with the outer rays much produced, filamentous, extending beyond root of caudal. Caudal pointed, scaly. Caudal peduncle $\frac{3}{4}$ as long as deep. Scales all cycloid, 28; lateral lines $\frac{18}{10}$. Blackish, more or less uniform, with 5 indistinct dark cross bars, and a black opercular spot; fins blackish, the soft rays of dorsal and anal indistinctly spotted.

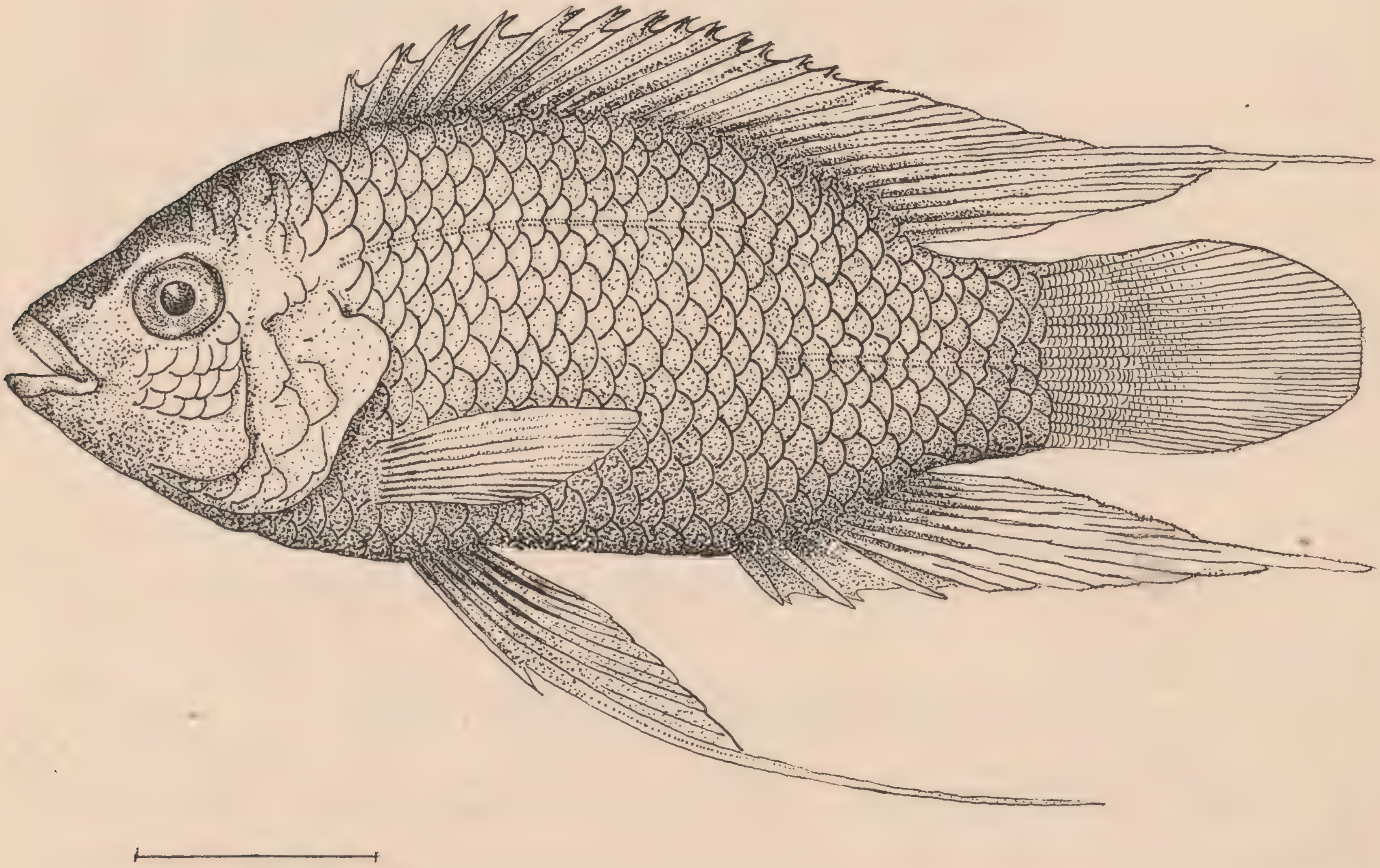


Fig. 29. *Paratilapia longipinnis*, type.

Besides the type we have 14 other specimens with the same data, and two others from Irebu, December 17, 1914. They exhibit the following range of measurements: length to base of caudal 70 mm. to 115 mm.; depth 2⅓–2½ times in this measure; gill-rakers 10–12; Dorsal XIV 10–11; anal III 8–9; scales occasionally denticulate, 26–28. The length of the filamentous rays of the various fins also varies slightly, due probably to wear or breaking.

This very distinct species is easily distinguished by its pointed, scaly caudal, and the long rays of its dorsal, anal and ventral fins. The dentition most closely resembles that of *P. polyodon.*

222. **Paratilapia xenodon** sp. nov.

With 9 gill-rakers on lower part of the anterior arch; premaxillary processes moderate, not extending to between the orbits; caudal rounded, scaly; some of the pharyngeal teeth with spherical crowns; depth of body 2¼ times in length to base of caudal; snout longer than postocular part of head; teeth in villiform bands.

The type, No. 6299, American Museum of Natural History, from Rungu, June 1913, is 297 mm. in length to base of caudal; depth 2¼ times in this measure; head 3 times. Head 1¾ times as long as broad, upper profile elevated, concave in front of the eyes, very high between them; greatest depth of head exceeding its length; snout rounded, as long as broad, slightly longer than postocular part of head; eye 5 times in length of head, 2 times in interorbital width, much less than preorbital depth; mouth not extending to below anterior border of eye; teeth in broad villiform bands, minute, conical, incurved; outer series of upper jaw larger, about 50; 5 or 6

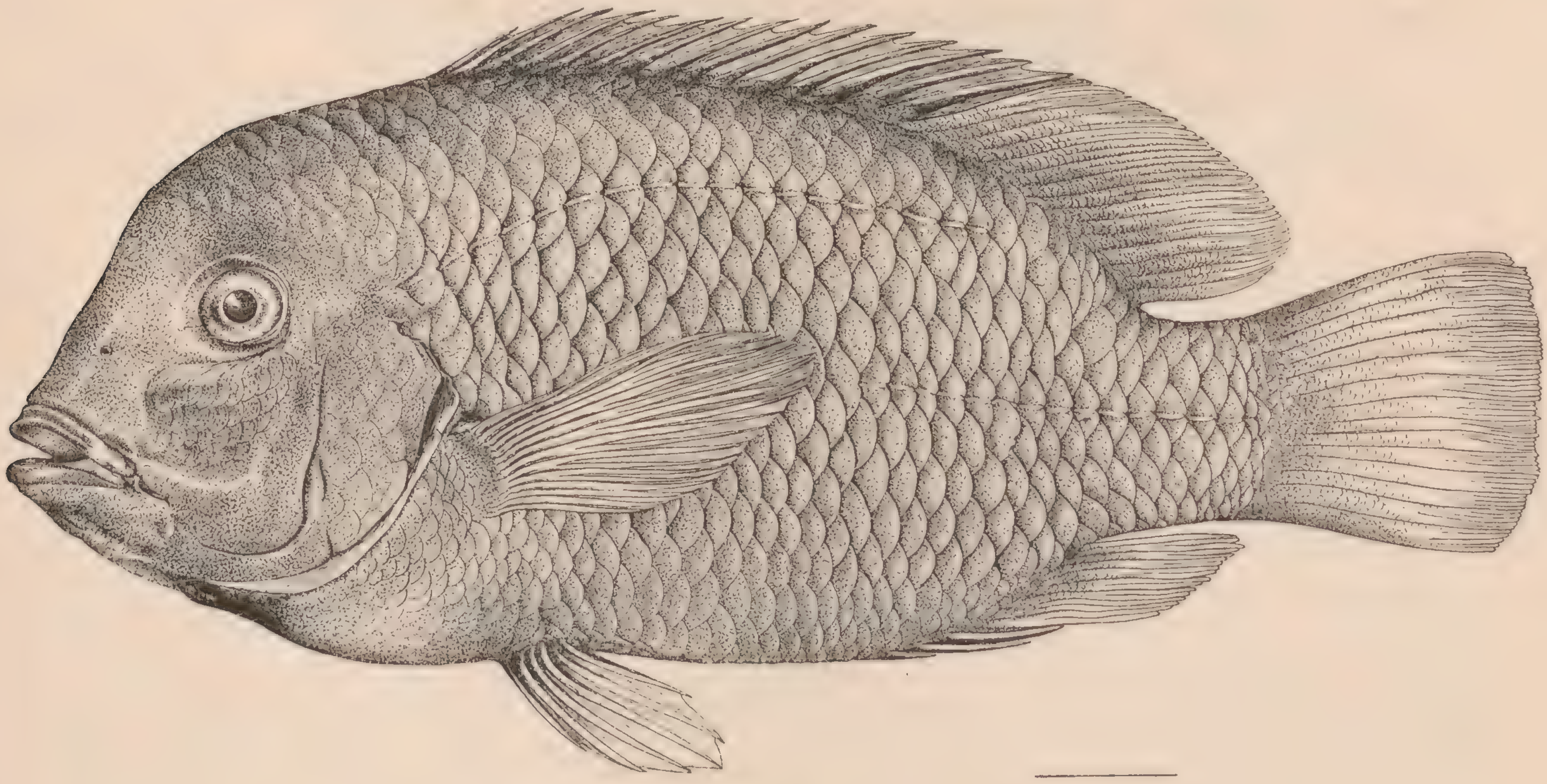


Fig. 30. *Paratilapia xenodon*, type.

series of scales on the cheek, width of scaly part greater than diameter of eye. Some of the pharyngeal teeth with spherical crowns. Gill-rakers very short, knob-like or anvil-like, 9 on the lower part of anterior arch. Dorsal XIV 15, spines increasing slightly in length to the last, which is $\frac{2}{5}$ length of head; longest soft ray about $\frac{1}{2}$ length of head. Anal III 9, third spine $\frac{1}{3}$ length of head. Pectoral $\frac{3}{4}$ length of head, not reaching vertical from origin of anal. Ventral reaching vent; caudal rounded, scaly. Caudal peduncle slightly longer than deep. Scales feebly denticulate, 29; lateral lines $\frac{19}{13-15}$. Uniform dark pinkish gray in life.

Besides the type we have 5 other specimens, all with the same data, measuring from 165 mm. to 235 mm.

This aberrant *Paratilapia* is remarkable for its dentition, which is apparently intermediate between *P. polyodon* and *Platytæniodus*. It fits exactly into neither, however, and might be regarded as generically separable. The classification of the Cichlidæ, however, is admittedly unsatisfactory, many of the genera founded on abnormal dentition being open to criticism. This being the case, another genus, founded on no better characters, would merely add to the already overburdened nomenclature, so the authors prefer to place this species provisionally in *Paratilapia*, to await the revision of the family, which seems so necessary.

223. **Nannochromis squamiceps** (*Boulenger*).

Several specimens, about 1 to 3 inches long, from Stanleyville. We consider this species doubtfully distinct from *dimidiatus*.

224. **Pelmatochromis lateralis** *Boulenger*.

Plate LXXVIII, Fig. 2, 3.

Several from 1 to about 10 inches in length from Avakubi, Faradje, Rungu and Stanleyville. Specimens from Rungu, June, were silvery gray, with more or less greenish reflections above, and more or less plain silvery below, one of them with a narrow golden line around the pupil. A specimen of about 7 inches from Faradje, December, was pearl gray and greenish above in more or less longitudinal stripes, whitish below, silvery throughout. Dorsal fin transparent gray with bright blue reflections on the spines and brownish red longitudinal markings. Caudal fin grayish edged with red on the lower half. Pectoral fin transparent gray. Ventral and anal fins pale blue gray, the former with red markings anteriorly. Top of the head in front of the eyes dark gray. Gill-covers yellowish and an area behind the head dusky yellowish gray. Some red markings between ventral and pectoral fins.

Specimens under 2 inches are from Faradje in December and February and Stanleyville in April. Others from 2 to 3 inches are from Stanleyville and Faradje in February, Faradje in March, Stanleyville in April and Rungu in June. We think there is some evidence here for a fall or winter spawning season. This species varies greatly in depth and in the outline of the profile which may be straight or convex.

225. **Hemichromis fasciatus** *Peters.*

Numerous specimens, about 1 to 6 inches in length, from Avakubi, Coquilhatville, Niangara, Niapu, Poko, Rungu, Stanleyville and Zambi. Specimens 2 inches and less in length are pretty well scattered through the year, February (Avakubi), April (Stanleyville), June (Zambi), November (Niangara), December (Avakubi). Mr. Chapin made a color sketch of a small one $3\frac{1}{2}$ inches long from Avakubi. It is dark green, somewhat mottled, including the fins with the exception of the ventrals. With 5 black blotches on the side. The ventral, extreme edge of the dorsal and upper caudal angle, breast, narrow longitudinal streaks on the flanks and points about the mouth and lower gill covers are red.

226. **Hemichromis bimaculatus** *Gill.*

Eight specimens, 2 or 3 inches long, from Zambi.

227. **Lamprologus obliquus** sp. nov.

Caudal rounded, sub-acuminate. Usually 6, sometimes 7 anal spines. Scales 32 to 38. Upper anterior and lower posterior lateral lines well developed. About 6 short gill-rakers on lower part of anterior arch. Depth in length to base of caudal 4 to 5. Eye in snout 1 (inch specimen) to 2 ($2\frac{5}{8}$ to 3 inch specimens). More or less distinct dark, broad cross-shades, and edges of scales dark, forming conspicuous narrow bars crossing the sides obliquely downward and backward.

The type, No. 5829, American Museum of Natural History, is 77 mm. long to base of caudal; depth $4\frac{1}{2}$ in this measure; head 3; eye $4\frac{1}{2}$ in head; snout $2\frac{2}{5}$; interorbital $5\frac{1}{2}$, maxillary $2\frac{3}{5}$. Body moderately compressed, its greatest depth at the nape, which is slightly swollen, ventral outline horizontal. Profile moderately oblique and convex to the nape, the dorsal outline thence drops in a very gentle convex curve to the front of the peduncle, the upper and lower outlines of which are about straight and parallel. Lower jaw slightly projecting, maxillary barely reaching front of eye. Dorsal inserted $\frac{1}{2}$ as far from snout as from base of caudal, continuous, the spines low, graduated, the last 3 in head, longest ray $1\frac{1}{3}$. Pectoral $1\frac{3}{5}$, ventral $1\frac{3}{5}$, just reaching vent. Anal similar to posterior dorsal, its last spine $3\frac{3}{5}$, its longest ray $1\frac{2}{5}$. Caudal sub-acuminate $1\frac{1}{5}$. Dorsal XIX 8. Anal VI 6. Scales ctenoid, 33, 26 in the upper anterior lateral line, 17 in the lower posterior. About 9 longitudinal series of large scales, the scales on the front of the back and on the belly much smaller and irregularly placed. Head naked, villiform bands of conical teeth in jaws, an outer series of larger conical curved brown-topped teeth in front of them, 3 on either side, the outer somewhat larger in the upper jaw; 2 on either side, the inner one rather small the outer large and canine-like, in lower jaw. A dark stripe back of the eye and blotch on opercle, edges of scales dark, pectoral pale, caudal with narrow dark bars extending obliquely downward and forward. Other fins blackish.

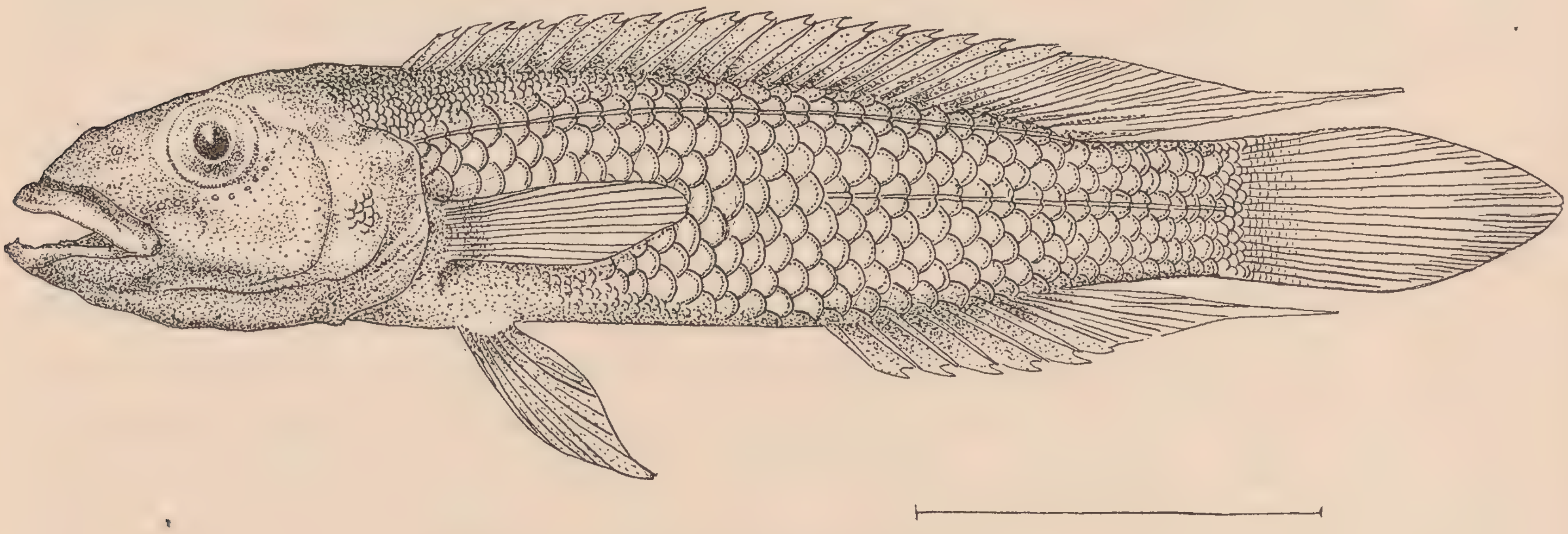


Fig. 31. *Lamprologus obliquus*, type.

This species has a smaller eye than *congolensis, tumbanus* and *mocquardii* and is notably more slender than the two former.

There are over 200 specimens from ½ to over 4 inches in length from Avakubi, Faradje, Garamba and Stanleyville.

ANABANTIDÆ.

228. **Anabas nigropannosus** (*Reichenow*).

Five specimens from Coquilhatville, one from Nouvelle Anvers, and several from Zambi. They range from about 3 to 6 inches in length.

229. **Anabas congicus** (*Boulenger*).

A single specimen 2 inches long from Zambi.

230. **Anabas nanus** (*Günther*).

Numerous specimens, about 1 to 3 inches in length, from Avakubi, Bafwabaka, Basoko, Faradje, Medje, Niangara, Niapu, Stanleyville and Vankerckhovenville. Some of these from Faradje in January were caught in swamps.

OPHIOCEPHALIDÆ.

231. **Ophiocephalus obscurus** *Günther.*

Plate LXXXI, Fig. 1; Plate LXXXIII, Fig. 1 (colored).

Several specimens, from about 2 inches to 2 feet in length, from Coquilhatville, Faradje, Malela, Rungu, Stanleyville, Vankerckhovenville and Zambi. We publish a color sketch by Mr. Chapin, who says that when seen in the water from above it shows a remarkable resemblance to *Polypterus.*

MASTACEMBELIDÆ.

232. **Mastacembelus congicus** *Boulenger.*

Plate LXXIII, Fig. 1 (colored).

One hundred or more specimens, about $1\frac{1}{2}$ to 18 inches in length, from Avakubi, Faradje, Niapu, Rungu and Stanleyville.

The few which are 3 inches and under were taken in January (Faradje, Niapu) and February (Faradje), perhaps indicating a definite spawning season. According to Mr. Lang's observation on two live ones about 8 inches long from Faradje, they keep the mouth slightly open, the slender snout slightly curved downward and the body in graceful curves, and can swim forward by moving the pectoral fins very rapidly. One of them had 3 neuropterous larvæ in its stomach. Our specimens of *Mastacembelus* vary greatly in color, but we find only the single species represented. We publish a color-sketch by Mr. Chapin, who says that in life the dorsal spines are usually not erected.

TETRODONTIDÆ.

233. **Tetrodon mbu** *Boulenger.*

Plate LXXIX, Fig. 1.

Eight specimens, 3 to 17 inches in length, from Faradje, Niangara, Poko, Rungu and Stanleyville. One of about 3 inches from Faradje was dark greenish brown above with yellow reticulations, yellow below lighter near the throat, caudal fin yellowish and brown, others transparent. In normal condition it measured 20 mm. in diameter, when inflated 52 mm. It made a rasping noise. When in the water the 2 small protuberances near nostril were erect, the pectoral fins moved very rapidly in undulations, the caudal fin was usually held contracted, though sometimes spread. Tetrodon is considered poisonous and not eaten by the natives of the northeastern Congo basin, excepting old men of the Mangbetu who eat them after skinning and removing the viscera. In this tribe they are supposed not to be detrimental to old men. The skin of *T. mbu* is used by the natives for polishing wood.

234. **Tetrodon miurus** *Boulenger.*

Several specimens, 1 to about 3½ inches long, from Stanleyville. When inflated the children sometimes use them to play ball with.

SPECULATIONS CONCERNING THE ORIGIN OF THE AFRICAN ICHTHYFAUNA.

Our knowledge of African fresh-water fishes has now undoubtedly reached a point where speculations as to their origin are justifiable. This does not mean that the authors consider that all the forms are known. Far from it. Unquestionably many species and possibly genera still remain undiscovered. It is, however, very doubtful if any such discovery would appreciably alter our general conception of the relationships of the fauna.

The evidence available for these speculations is first the distribution of African and closely related forms in other parts of the world, and secondly the distribution of fossils. Other things being equal, it is most likely that those families exhibiting the greatest diversity of structure and specialization, and whose range is the widest in Africa, appeared there first. The fact, for instance, that African Siluridæ exhibit a greater diversity of structure than their relatives the Characinidæ is evidence that they reached Africa first; although (as science is quite unable to show that their rates of development were the same) the evidence is not conclusive. In many instances palæontology has proved that the present distribution of a given group is not necessarily an indication of where it originated, the camels and horses being excellent illustrations. The best thing we can do therefore is to present what evidence there is for each family, and what conclusions and interpretations might logically be inferred from such evidence.

Polypteridæ.

This family, characteristic of west tropical Africa, is found nowhere else in the world. Crossopterygians were however abundant in palæozoic times, and continued in the northern hemisphere into the Cretaceous.

Bearing in mind the fact that at this time three quarters of the northern hemisphere was under water, and that there was probably a great antarctic continent (evidenced by the distribution of *Galaxias*, etc., and fossils), it seems safe to suppose that this group originated or entered fresh water in the south, and that their descendants, the Polypteridæ, have at least been in Africa for countless ages.

Lepidosirenidæ.

This family is now confined to tropical South America and Africa with the related *Neoceratodus* in Australia. Fossil Dipnoi are abundant in the northern hemisphere in palæozoic and secondary formations, and have recently been found in Antarctica. This argues strongly for their origin in a former Antarctic continent, Gondwanaland, and their gradual spreading northward. Their survival in isolated tropical stations is explained by the continuance of favorable climatic conditions, which apparently existed in the northern hemisphere in former ages when they flourished there, and the end of which conditions resulted in their early extinction. Unquestionably a very ancient group in Africa.

Malacopterygii.

Osteoglossidæ
Mormyridæ
Notopteridæ
Pantodontidæ
Phractolæmidæ
Kneriidæ
Cromeriidæ

With the exception of *Notopterus* and the Osteoglossidæ, no fossils of these families are known. *Notopterus* has been found in the Tertiary of Sumatra, and Osteoglossidæ in the Eocene of Wyoming and Sheppey. The present distribution of these families shows conclusively that they are isolated cases of survival. This is confirmed by the fact that Malacopterygian fossils of families now extinct were abundant in the Jurassic and of wide-spread distribution. To quote from Alexander Meek:[1] "These and other Teleosts appeared in the northern hemisphere about the time Gondwanaland was being lost. The relationships of some of their predecessors in the formations of the north are not yet clear, but they are believed in all cases to be Proostean. This and the fact that the pioneers of the Cretaceous were recognizable as family types, many of which are still living (ex. Elopidæ), go to show that Teleosts originated in the south." Knowing nothing to the contrary it seems most reasonable to suppose Teleosts of marine origin, but there is much to be said in favor of Meek's reasoning, as applied to Malacopterygii. Granting for the moment that they originated in the north, they must have reached Africa certainly before they became extinct in the northern hemisphere. It is highly improbable that they could have done so, because even so late as Eocene times, most of Northern Africa was under water, and a gigantic Mediterranean three times as wide as it is now stretched all the way to the Bay of Bengal. In any event these peculiar fishes have been in African waters for a very long period of time.

---

[1] The Migrations of Fish. London, 1916.

Ostariophysi.

Characinidæ.— Today Characins are abundant in tropical America and tropical Africa. They are found nowhere else, and as they are diversely specialized in each continent, it may safely be presumed that they have occupied them for a long period of time. The only fossil known is a member of an existing genus *Tetragonopterus,* from the Tertiary of San Paulo, Brazil. There is, therefore, absolutely no fossil evidence as to their place of origin.[1] The probabilities will be discussed later on.

Siluridæ.— Taking up the fossil evidence first, we are struck by the fact that there are no pre-Tertiary ones. The oldest are all related to the marine *Arius.* Otherwise there is nothing until late Tertiary, where remains are fairly numerous. It is remarkable, however, that all these fossils are either referable to living genera or closely related to them. *Clarias* and *Heterobranchus* for instance have been found in the Lower Pliocene of India. As regards existing species the family is largely tropical in distribution. Of the 9 subfamilies into which it is divided, one is marine (*Plotosus*), 3 are purely Neotropical; *Malopterurus* is confined to tropical Africa; the Clariinæ center around the Indian Ocean region, the Silurinæ have a similar distribution but have spread to Europe and China; the Bagrinæ are most abundant here also, but a large number are found in North America, and a few in Northern Asia; the Doradinæ are confined to the tropical regions of both hemispheres. This distribution would seem to indicate a southern origin, borne out by the fact that the northern fossils are all of recent date and do not indicate that the family was any more abundant in the north formerly than now.

Cyprinidæ.— This is the predominant family of fresh-water fishes in the northern hemisphere, over 2000 species being recognized. To be noted especially is the fact that they are absent entirely from South America and Australia. The northern hemisphere was fully occupied during the Tertiary period, as an abundance of fossil material proves. Remains in the Oligocene and Miocene deposits of Europe, Nevada and Sumatra are referred to living genera and in many cases to living species. They were apparently forced south to a great extent by the Ice Age. Four subfamilies are recognized: (1) the Cyprininæ, with about the same range as the family, and to which all but one of the African species belong; (2) Catostominæ, North American, with the exception of 3 or 4 which have reached Northern Asia; (3) Cobitidinæ, Europe, Asia and Abyssinia; (4) Homalopterinæ, a small, aberrant group found in India, China and Malaya. With this evidence and the fact that they greatly predominate in Northeastern and Eastern Africa, we have no hesitation in saying that they reached that continent comparatively recently from Europe and Asia from a northeasterly direction.

---

[1] See however the following paper by C. R. Eastman (Art. XXVI, pp. 757–760).

The problem of the origin of the Ostariophysi is perhaps the most difficult one in fresh-water fishes, as what evidence we have is contradictory. The present distribution of the Characins and Silurids, and the recentness of the fossils of the latter point towards a southern origin for these two families; the Cyprinids are, we think, the key to the situation. Meek, believing in a southern origin for the first two families on the evidence stated above, argues as follows for the southern origin of the Cyprinidæ: "The loaches come nearest to the catfishes, and from the distribution of these, and the above consideration, it may be said that the Cyprinidæ originated in the south and appeared in the north in the Tertiary period." The writers are however quite unable to accept this view. It would, as a result, be quite impossible to account for their absence from South America and Australia. No other family of fish whose origin is undoubtedly southern, or even presumably so, are absent from these two regions. The distribution of all the living Malacopterygians is an excellent case in point. Furthermore a study of our table of distribution will show conclusively that the African members of the family came from the north. It is in the northern hemisphere then that we must look for the origin of this family.

What is to become then of the Characins and the Silurids? The writers refuse to grant that two families of the same suborder would originate independently in different parts of the earth. All three families originally sprang from a common ancestor, and the place of origin of all three families was probably in a general way the same. They are admittedly of recent origin and all ancient fish have been common or abundant in the northern hemisphere during Palæozoic and Secondary time. The Ostariophysi probably originated here and then spread southward supplanting older and more primitive forms. The Siluridæ reached South America and Africa first, developing to a greater extent in the former continent, where there were fewer primitive fishes to compete with. The fact that many of them were adapted to a marine life may well have hastened their spread. The Characins came next. The Cyprinidæ undoubtedly moved south last, the Ice Age possibly providing an important impetus. These have entirely failed to reach South America and the Australian region.

Galaxiidæ.—There are no fossils. The present distribution of this family points to an origin in Gondwanaland. They were put by Boulenger in the suborder Haplomi, but Regan has recently shown their affinities to be with the Salmonidæ, showing them to be more primitive than formerly believed. This would fit into our belief that primitive fresh-water fishes originated in the south, and the more recent fishes in the north.

Acanthopterygii.

Osphromenidæ	*Ophiocephalidæ*
Anabantidæ	*Mastacembelidæ*

These peculiar families have a remarkable distribution. They are all confined to southeastern Asia, Malaya and tropical Africa, where they predominate in the west tropical region. Of these *Ophiocephalus* alone has furnished fossils from the Pliocene of the Siwalik Hills in India. As far as living genera and species go, these families are much more abundant in Asia and Malaya. They probably originated there and worked east to Africa, isolated species in Syria and Afghanistan serving as connecting links. In Africa they exist only in the west tropical region and the Upper Nile where conditions parallel those of southern Asia and Malaya in so far as climate is concerned.

Cichlidæ.—The distribution of this family in Africa cannot be compared with that of any other fresh-water group. About three-quarters of the genera center around the great central lakes, and the remaining quarter are wide-ranging and characteristic of no particular region. *Tilapia* is particularly remarkable, 2 species reaching Syria, 2 Madagascar and several are found in various hot springs and mineral lakes in East Africa. Outside of Africa the family is found only in tropical America, although fossils from the Eocene of Green River and Utah point to a more extended northward distribution when the climate was warmer. Their nearest living allies are the Pomacentrids and related salt-water fishes found throughout tropical seas wherever there are coral reefs. The presence of several Cichlids in Madagascar and their known indifference to brackish water suggest that they were originally of marine origin, descended perhaps from Pomacentrids or a common ancestor and had specialized or differentiated to some extent before leaving the sea. To account for their origin in any other way would necessitate giving them an extreme antiquity, as Madagascar has certainly been separated from Africa since the middle of the Secondary period. Their close relationship to various Perciform fishes on the other hand places them as recent and specialized.

Résumé.— The fresh-water Crossopterygians, Dipnoi and Malacopterygians are very ancient fish which probably originated in the south and have been present in Africa a very long time. The Ostariophysi are of comparatively recent northern origin, and invaded Africa from the north; the Cyprinidæ unquestionably so, and most recently. Various Acanthopterygians are not native to Africa but reached that continent from the Orient, with the exception of the Cichlids, which were of marine tropical origin and became adapted to a fresh-water existence in various parts of Africa and elsewhere at about the same time.

AFRICAN FRESH-WATER ICHTHYFAUNÆ.

With the completion of Vol. IV of Boulenger's invaluable 'Catalogue of fresh-water Fishes of Africa' it is possible to gain a comprehensive view of their general distribution for the first time. Wallace's discussion of Africa in his classic work, 'Geographical Distribution of Animals,' virtually omits the fishes from consideration, as at the date of his writing they were very imperfectly known. The great strides made in African ichthyology in the last 25 years now make it possible to use the fishes as important collateral evidence in the fascinating problem of African Zoögeography.

As the easiest way of presenting the facts, the writers have prepared a table (pp. 746–752) of the distribution of all the strictly fresh-water families and genera. A few words of explanation about this table are necessary. The continent has been divided into 6 sections of unequal size, and the number of species in each section of every genus has been given. These sections, and the regions to be made from them, will be fully discussed later. A column has also been supplied for the total number of species in each genus. In many cases it will be seen that the sum of the species in the 6 sections exceeds the total number of species in Africa. This means that one or more species of a given genus are widely distributed, occurring in two or more of the sections. It will also be noted that several families, included in Boulenger's Catalogue, have been omitted. These are of two classes, first, marine families, with peculiar genera or species occurring exclusively in fresh-water; second, marine families, some species of which occur occasionally up the mouths of the larger rivers. Such are regarded in this paper as of recent adaptation to a new environment, and are omitted because they have no bearing upon the principles of distribution to be laid down. In the case of the great central lakes, no little difficulty has been experienced in deciding to what section their fish fauna belongs. For instance, a fish confined to Lake Tanganyika has closely related species in west and southeastern Africa. Into which region should this fish go? The writers have, therefore in certain cases, been somewhat arbitrary, and are aware that an opposite opinion might be maintained with as good cause.

A careful study of these tables shows that from a general standpoint the fresh-water fishes of Africa have the following arrangement geographically:—

1. The fishes of northwest Africa are closely related to those of Europe.

2. The fishes of west tropical Africa (from the Niger to Angola, and east to the high central mountains or the central lakes) are very distinct and either confined to that region or related to South America, Australia and Southeastern Asia. This region is by far the richest in Africa, containing more than half of all the recorded African species.

3. The fishes of the Nile basin and Ethiopia are either most closely related to northern or Asiatic forms or else to west tropical forms. For a considerable period of time there must have been a water connection of some sort between the Nile basin and west tropical Africa. In fact our collector, Mr. Lang, states that in the extreme Upper Congo near Garamba he found a swamp draining both ways during the height of the rainy season. This fact must be borne in mind if the distribution of fish in Africa is to be understood, and it is well proved as follows:

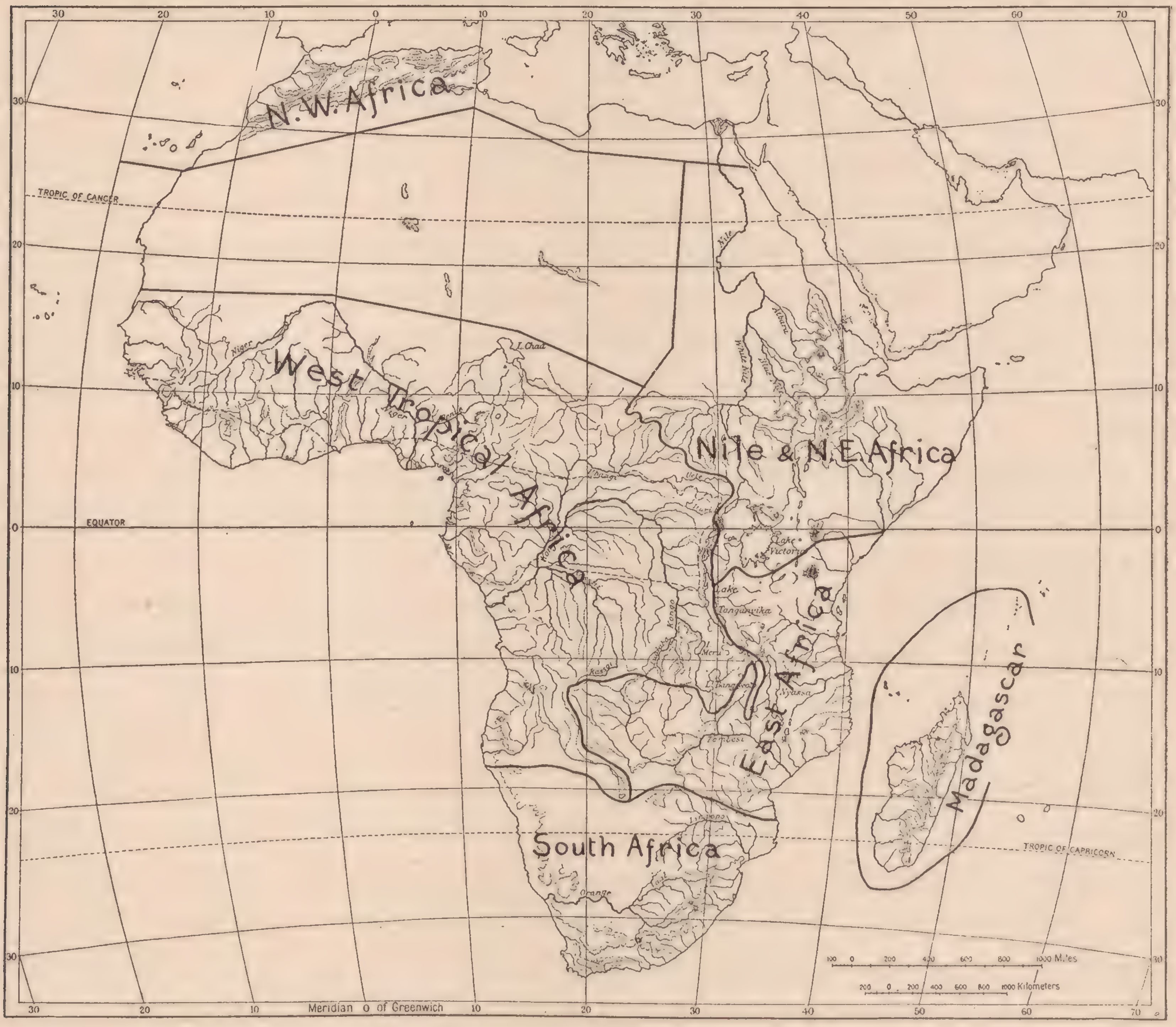
a. There are nearly 100 species of fish common to the Nile basin and west tropical Africa. Very few of these reach East Africa and none South Africa.

b. Fish of probable northern or oriental origin are commoner in the Nile basin, East and South Africa than in west tropical Africa where they occur in reduced numbers, usually in the northern or extreme northeastern sections of the regions.

4. The fishes of East Africa (excluding the Nile drainage and south to the Limpopo River) are few in numbers comparatively and exhibit a close relation to those of the Nile basin. A very few west tropical African forms which have reached the Nile basin have succeeded in establishing themselves further south in East Africa, arriving there undoubtedly by the same means used by fish of northern or Asiatic origin. The fish fauna of South Africa is poor and limited, most closely related to that of eastern Africa and the Nile basin. It does not constitute a separate faunal region for fresh-water fishes.

5. Madagascar has no real ichthyological affinities with Africa.

The boundaries of these 5 regions are approximately shown on the accompanying map. A word, however, must be said about the great central lakes. The difficulties encountered have already been alluded to. Suffice it to say that the authors here consider their regional affinities to be as follows: Lakes Victoria and Albert Edward are undoubtedly homologous in their ichthyfauna with the Nile basin. Lakes Bangweolo and Moero should unquestionably be included in west tropical Africa. Lake Nyassa, southeast of Lake Tanganyika, is best put in the East African region. Lake Tanganyika is the great problem, and the writers do not believe it can definitely be assigned to any one region. Boulenger, in his 'Poissons du Bassin du Congo,' includes it in west tropical Africa (its present direct water connection is with the Congo drainage through the Lukuga River at high water) although in his preface he calls it "un bassin à part." This treatment, however, is quite impossible. The lake is extremely rich in forms. Excluding a large number of peculiar genera for the moment, our



Map 2. Africa, indicating the divisions used in the discussion of the ichthyfauna.

treatment has been as follows: Those species whose relatives are predominatingly west tropical African have been classed in that region, and those whose relatives are predominatingly east African have been put in the latter region. In the case of peculiar genera, all families except the Cichlidæ, were characteristic of one region or the other (usually west tropical) and they have been classed accordingly. In the Cichlidæ, however, which do not predominate in any one region, and where no less than 23 genera are confined to this lake, it has been impossible to decide, and we have arbitrarily placed them in the East African region. Aware, however, that others might think differently we have in every case indicated their restricted range in the table.

The various families of fresh-water African fish fall conveniently into 3 general groups:

1. Fish of primitive or specialized structure, which either originated in Africa or have survived there only. It is highly important from the standpoint of zoögeography to note that all such are practically confined to west tropical Africa, a few species only appearing in the Nile basin or East Africa.

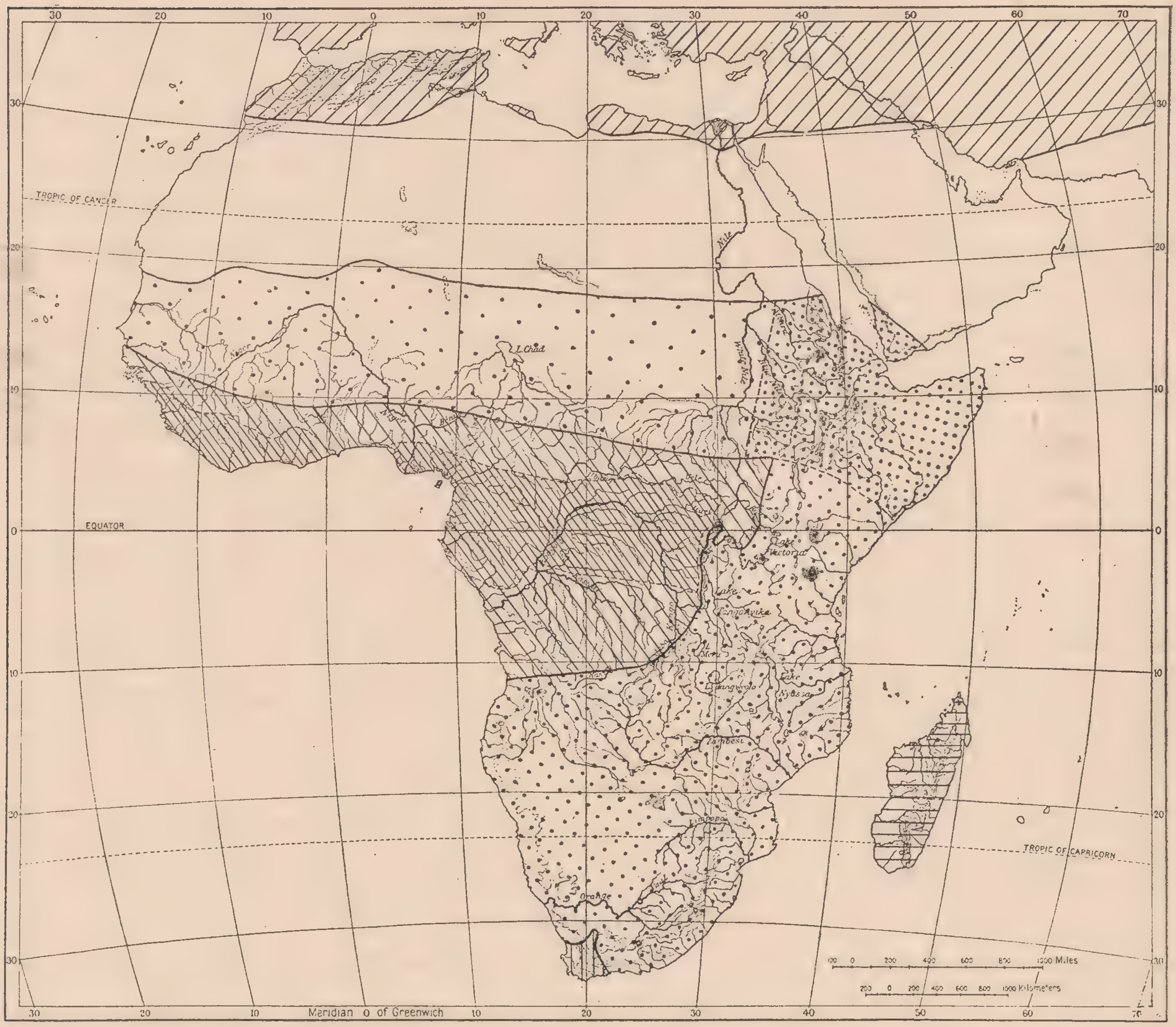
2. Families of the *present*, with tropical range only. These too are either confined to west tropical Africa or predominate there enormously. The Characinidæ are the best example.

3. Families of cosmopolitan distribution, well represented in the northern hemisphere and of possible northern origin; also various genera of undoubted northern origin. These seem invariably to have entered Africa from the northeast. They predominate in the Nile basin and East Africa, reaching South Africa, but are much more poorly represented in west tropical Africa. Various genera of Cyprinidæ furnish the best example.

It remains to compare our regions, which are as yet purely ichthyological, with the division of the continent by biogeographers who have availed themselves of all the available evidence furnished by the plant and animal kingdoms. It is therefore interesting to note that our regions are in entire accord with those of biogeography. Northwest Africa can be eliminated as being obviously holarctic, the evidence supplied by its fishes being as good as that by any other forms of life; Wallace divides the remainder of the continent into 3 regions, West Africa, East Africa and South Africa. Madagascar and the Mascarene Islands constitute his fourth sub-region. The fact that we separate the Nile basin and northeast Africa is largely a matter of convenience, as their ichthyfauna and flora is a mixture of holarctic, east African and west tropical forms, which is easily accounted for as explained above. A much more recent map showing biogeographical regions on the evidence of the flora as studied by Engler has been worked out by our colleagues at the American Museum of Natural History who are especially interested in African faunæ (Messrs. Lang and Chapin and Dr. Bequaert). Our West African region for the fish includes the forest region and the comparatively open belts north and south of it. Wallace's South African region has now been shown to be much less marked than he supposed by the discovery of many of its alleged peculiar forms in East Africa, and the terrestrial faunæ accord very well with the regions on this map which is based on floræ.

While therefore our ichthyological regions are to all intents and purposes in accord with the latest findings of biogeographers there is one difference which may be emphasized. South and East Africa contain a large number of peculiar forms of plant and animal life, found nowhere else in the continent. It might therefore be expected that the fish fauna of this region would also contain some at least of the peculiar African families and genera. Nothing is further from the facts. The poverty-stricken fish fauna is obviously nothing more than a diminished representation of Nile basin and west African forms. With one exception all the peculiar African families are purely west tropical. This exception is *Galaxias,* confined to the region of Cape Town, a limited area which Engler makes a separate region on the basis of its aberrant flora. Recent exploration of west tropical Africa has also shown an increasing number of peculiar forms of animal life other than fish. In fact it is probable that West Africa should now replace South Africa as the peculiar faunal division of that continent. Just how this should modify themes advanced to explain the South African fauna and flora by a vast Antarctic continent which connected South Africa, southern South America and Australia, it is at present difficult to say; Meek in 'The Migrations of Fish' collects all the evidence and argues strongly for this Antarctic continent, Gondwanaland, which served, he says, as an ancient center of distribution for most of the living fresh-water fishes. He particularly included those families belonging in our first two classes. If South Africa was a part of Gondwanaland it is certainly curious that these peculiar families should be entirely absent except for *Galaxias.*

The explanation is to our minds largely a geological and climatological one. The existence of Gondwanaland is generally admitted to explain not only present day facts of distribution, but also is largely proved by the fossils recently brought back from Antarctica. The fish remains from the Beacon Sandstone of Antarctica are of the same nature as those laid down in similar deposits of river and lake origin in Russia and Scotland. The plant remains also testify to this land connection. The famous Permian *Glossopteris* flora of the Damuda beds in India, the coal deposits of Australia, and the Ecca beds of South Africa has been found in Antarctica, a flora which also extended north to Russia and Siberia in the Permian and persisted in tropical situations as remote as Mexico and China in Mesozoic



BOTANICAL REGIONS OF AFRICA

after ENGLER

I. MEDITERRANEAN REGION . . . . ▨

II. NORTH AFRICAN-ARABIAN DESERT REGION . . □

III. ETHIOPIAN REGION

- A. SAVANNAH PROVINCE
  - 1. SUDANESE SUBPROVINCE . . . . ∴
  - 2. NORTHEASTERN SUBPROVINCE . . . . . . ⠿
  - 3. EASTERN & SOUTHERN SUBPROVINCE . . . . ⁙
- B. WESTERN FOREST PROVINCE . . . . ▧
  - Extent of Rain Forest indicated thus . . . . ▩

IV. SOUTHWESTERN CAPE REGION . . . . . . ▥

V. MALAGASY REGION . . . . ▤

times. We also know that Graham Land in Antarctica possessed a rich Jurassic flora.

Turning now to geological conditions in Africa it should be noted that practically the whole continent south of the Sahara so far as known is Permian, Triassic and Jurassic. Tertiary deposits are very rare. It should also be noted that the more primitive and ancient African fishes are almost all Crossopterygii, Dipnoi, or Malacopterygii, which reached their maximum development during these geological periods. In the words of Meek: "In the southern hemisphere swamps and fresh-water conditions generally have apparently persisted from a period even before Gondwanaland disappeared and Antarctica lost its connection with Australia and America, and have allowed of the survival of primitive types." The absence of these primitive types from South Africa might be explained by gradual desiccation of climate in some way correlated with the considerable geographic changes. We know that the ancient *Glossopteris* flora required a humid, moist climate. These primitive fishes therefore would either have become extinct in South Africa or have found some means to migrate to more congenial conditions, namely those at present prevailing in west tropical Africa. The absence of fossils is easily accounted for by the rarity of Tertiary or Quaternary deposits.

The present flora and fauna of South Africa support this view. The flora of the region around Cape Town, already alluded to, may be regarded as a survival of ancient conditions, borne out by the fact that certain species and genera still exist in scattered localities further north and east. The present flora of the rest of South and East Africa has been shown by Engler to be exclusively of oriental or northern origin. Dr. Bequaert tells us that many modern Hymenoptera occur only south of the Orange River. The fishes are obviously of northern or Asiatic origin, as are largely the birds, and without going into details, the findings of palæontology render it very doubtful if the ancestors of any of the present East and South African mammals originated there.

To recapitulate briefly, the available facts indicate that the most ancient and primitive types of fishes originated in South Africa or some southern continent of which it was a part, as evidenced by their fossil remains. That these types became extinct there due to a steady desiccation of climate, and their least differentiated descendants still exist around Cape Town and in west tropical Africa where favorable conditions for their existence have persisted. The present fauna and flora of Africa excluding these primitive types are comparatively recent and derived from northern or oriental sources.

Due to the absence of mountain barriers, and the close approximation of the river systems much of this recent derived fauna and flora is found in west tropical Africa.

Distribution of African Fishes.[1]

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Polypteridæ	Nile & Tropical Africa							
Polypterus		12	0	3	0	0	11	0
Calamichthys		1	0	0	0	0	1	0
Lepidosirenidæ	Tropical Africa & S. America							
Protopterus		3	0	1	1	0	2	0
Mormyridæ	Nile & Tropical Africa							
Mormyrops		19	0	3	1	0	17	0
Petrocephalus		13	0	5	2	1	9	0
Isichthys		1	0	0	0	0	1	0
Marcusenius		30	0	4	1	2	25	0
Stomatorhinus		6	0	0	0	0	6	0
Myomyrus		2	0	0	0	0	2	0
Gnathonemus		33	0	3	3	1	30	0
Genyomyrus		1	0	0	0	0	1	0
Mormyrus		16	0	4	2	2	10	0
Hyperopisus		1	0	1	0	0	1	0
Gymnarchus		1	0	1	0	0	1	0
Notopteridæ	S. E. Asia & Tropical Africa							
Notopterus		1	0	0	0	0	1	0
Xenomystus		1	0	1	0	0	1	0
Osteoglossidæ	S. America Australia East Indies Africa							
Heterotis		1	0	1	0	0	1	0
Pantodontidæ	West Tropical Africa							
Pantodon		1	0	0	0	0	1	0

---

[1] See Map No. 2, p. 741.

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Clupeidæ								
Pellonula	Tropical Africa	6	0	0	0	0	6	0
Odaxothrissa		2	0	0	0	0	2	0
Microthrissa		2	0	0	0	0	2	0
Salmonidæ	Mostly holarctic							
Salmo		1	1	0	0	0	0	0
Phractolæmidæ	West Tropical Africa							
Phractolæmus		1	0	0	0	0	1	0
Kneriidæ								
Kneria	Tropical Africa	3	0	0	1	1?	2	0
Xenopomatichthys		2	0	0	1	0	1	0
Cromeriidæ	White Nile							
Cromeria		1	0	1	0	0	0	0
Characinidæ	Central & S. America, Tropical Africa							
Sarcodaces		1	0	0	0	0	1	0
Hydrocyon		5	0	3	1	1	5	0
Brycon æthiops		1	0	0	0	0	1	0
Alestes		31	0	6	4	2	26	0
Micralestes		7	0	1	1	1	7	0
Petersius		15	0	0	2	0	13	0
Eugnathichthys		2	0	0	0	0	2	0
Paraphago		1	0	0	0	0	1	0
Mesoborus		2	0	0	0	0	2	0
Phago		3	0	0	0	0	3	0
Neoborus		2	0	0	0	0	2	0
Ichthyoborus		1	0	1	0	0	0	0
Hemistichodus		1	0	0	0	0	1	0
Microstomatichthyoborus		1	0	0	0	0	1	0
Nannæthiops		2	0	1	0	0	2	0
Neolebias		4	0	0	0	0	4	0

Distribution of African Fishes.— (Continued.)

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Distichodus		19	0	4	2	0	16	0
Nannocharax		11	0	1	0	0	10	0
Xenocharax		2	0	0	0	0	2	0
Citharidium		1	0	0	0	0	1	0
Citharinus		5	0	2	1	0	5	0
Cyprinidæ								
Labeo	S. Asia & Africa	51	0	6	13	10	29	0
Discognathus	S. Asia & Africa	8	0	3	5	0	2	0
Varicorhinus	S. W. & Cent. Asia & Africa	16	1	0	5	2	8	0
Barbus	Asia & Africa & Europe	249	13	54	66	48	76	0
Rasbora	E. & S. E. Asia & Africa	1	0	0	1	0	0	0
Leuciscus	Holarctic	2	2	0	0	0	0	0
Leptocypris	Congo	1	0	0	0	0	1	0
Barilius	China & S. E. Asia Nile & Trop. Africa	22	0	2	6	1	15	0
Engraulicypris	Nile & Trop. Africa	6	0	2	2	1	1	0
Chelæthiops	Nile & Congo	2	0	1	0	0	1	0
Nemachilus	Europe, Asia & Africa	1	0	1	0	0	0	0
Siluridæ	Cosmopolitan							
Clarias	S. E. Asia, Syria Africa	39	0	5	5	4	27	0
Allabenchelys	W. Tropical Africa	3	0	0	0	0	3	0
Clariallabes	W. Tropical Africa	2	0	0	0	0	2	0
Gymnalabes	W. Tropical Africa	1	0	0	0	0	1	0
Channallabes	W. Tropical Africa	1	0	0	0	0	1	0
Heterobranchus	Malay Archipel. Africa	3	0	1	1	0	3	0

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Dinotopterus	Lake Tanganyika	1	0	0	0	0	1	0
Eutropius	Nile & Trop. Africa	16	0	1	2	0	14	0
Shilbe	Nile & Trop. Africa	4	0	2	1	0	3	0
Ansorgia	W. Trop Africa	1	0	0	0	0	1	0
Siluranodon	Nile	1	0	1	0	0	0	0
Physailia	Trop. Africa	5	0	2	0	0	3	0
Parailia	W. Trop. Africa	2	0	0	0	0	2	0
Bagrus	Nile & Trop. Africa	7	0	4	2	0	2	0
Chrysichthys	Nile & Trop. Africa	26	0	2	0	0	24	0
Gnathobagrus	W. Trop. Africa	1	0	0	0	0	1	0
Amarginops	W. Trop. Africa	1	0	0	0	0	1	0
Clarotes	Nile & Trop. Africa	1	0	1	1	0	1	0
Siluridæ								
Gephyroglanis	Trop. & S. Africa	7	0	0	0	1	6	0
Phyllonemus	Lake Tanganyika	1	0	0	0	0	1	0
Leptoglanis	Trop. Africa	2	0	0	1	0	1	0
Amphilius	Trop. Africa	14	0	1	6	0	8	0
Paramphilius	Senegal	1	0	0	0	0	1	0
Parauchenoglanis	W. Trop. Africa	3	0	0	0	0	3	0
Auchenoglanis	Nile & Tropical Africa	10	0	2	0	0	10	0
Notoglanidium		2	0	0	0	0	2	0
Niauchenoglanis	All confined to Africa	1	0	0	0	0	1	0
Ancharius		2	0	0	0	0	0	2
Arius		6	0	0	1	0	4	1
Synodontis		63	0	13	6	0	49	0
Microsynodontis		1	0	0	0	0	1	0
Chiloglanis		7	0	2	3	0	2	0
Euchilichthys		4	0	0	0	0	4	0
Atopochilus		2	0	0	0	0	2	0
Acanthocleithron		1	0	0	0	0	1	0

Distribution of African Fishes.— (Continued.)

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Mochocus		2	0	2	0	0	0	0
Doumea		3	0	0	0	0	3	0
Phractura		7	0	0	0	0	7	0
Paraphractura		1	0	0	0	0	1	0
Trachyglanis		1	0	0	0	0	1	0
Belonoglanis		1	0	0	0	0	1	0
Andersonia		1	0	1	0	0	0	0
Malopterurus		1	0	1	0	0	1	0
Galaxiidæ								
Galaxias	Seas & fresh waters of S. Africa, S. South Amer., N. Zealand & nearby isl., Australia & Tasmania	2	0	0	0	2	0	0
Nandidæ	West Africa Southeast Asia, South America							
Polycentropsis		1	0	0	0	0	1	0
Cichlidæ	Africa, Syria India, Ceylon & Trop. America							
Tilapia		96	0	15	42	4	40	2
Petrochromis	Lakes Tanganyika & Nyassa	5	0	0	5	0	0	0
Cunningtonia	Lake Tanganyika	1	0	0	1	0	0	0
Simochromis	"	1	0	0	1	0	0	0
Tropheus	"	2	0	0	2	0	0	0
Asprotilapia	"	1	0	0	1	0	0	0
Labochilotes	"	1	0	0	1	0	0	0
Doeimodus	Lake Nyassa	1	0	0	1	0	0	0
Steatocranus		1	0	0	0	0	1	0
Haplochromis		16	0	11	5	1	4	0
Paratilapia		56	0	17	24	0	14	1
Nannochromis		3	0	0	0	0	3	0

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Pelmatochromis		39	0	6	8	0	25	0
Platytæniodus	Lake Victoria	1	0	1	0	0	0	0
Hemichromis		2	0	1	0	0	2	0
Champsochromis	Lake Nyassa	3	0	0	3	0	0	0
Bathybates	Lake Tanganyika	6	0	0	6	0	0	0
Haplotaxodon	“	1	0	0	1	0	0	0
Cyrtocara	Lake Nyassa	1	0	0	1	0	0	0
Ectodus	Lake Tanganyika	1	0	0	1	0	0	0
Enantiopus	“	2	0	0	2	0	0	0
Stappersia	“	1	0	0	1	0	0	0
Xenotilapia	“	2	0	0	2	0	0	0
Grammatotria	“	1	0	0	1	0	0	0
Trematocara	“	3	0	0	3	0	0	0
Gephyrochromis	“	1	0	0	1	0	0	0
Lamprologus	“ & Congo	27	0	0	0	0	27	0
Julidochromis	Lake Tanganyika	1	0	0	1	0	0	0
Telmatochromis	“	2	0	0	2	0	0	0
Bayonia	Victoria Nile	1	0	1	0	0	0	0
Hemitilapia		3	0	2	1	0	0	0
Chilochromis		1	0	0	0	0	1	0
Corematodus		1	0	0	1	0	0	0
Eretmodus	Lake Tanganyika	1	0	0	1	0	0	0
Spathodus	“	1	0	0	1	0	0	0
Perrisodus	“	1	0	0	1	0	0	0
Chilotilapia	Lake Nyassa	1	0	0	1	0	0	0
Schubotzia	Lake Albert Edward	1	0	1	0	0	0	0
Xenochromis	Lake Tanganyika	1	0	0	1	0	0	0
Plecodus	“	1	0	0	1	0	0	0
Paretroplus		2	0	0	0	0	0	2
Osphromenidæ	S. E. Asia & Africa							
Micracanthus		1	0	0	0	0	1	0
Anabantidæ	S. E. Asia, Trop. & S. Africa							

Distribution of African Fishes.— (Concluded.)

	World Range	Total no. of African species	N. W. Africa	Nile & N. E. Africa	East Africa	South Africa	West Tropical Africa	Madagascar & Mascarene Islands
Anabas		16	0	2	0	3	11	0
Ophiocephalidæ	E. & S. E. Asia Trop. Africa							
Ophiocephalus		3	0	1	0	0	3	0
Gasterosteidæ	Holarctic							
Gasterosteus		1	1	0	0	0	0	0
Mastacembelidæ	South Asia & Trop. Africa							
Mastacembelus		34	0	1	2	0	31	0

EXPLANATION OF PLATES LXIV–LXXXIII.

Plates LXXX–LXXXIII in color.

Plate LXIV.

Fig. 1. *Mormyrops deliciosus* (Leach). Faradje. Total length 1060 mm.
Fig. 2. *Marcusenius psittacus* (Boul.). Faradje. Total length 185 mm.
Fig. 3. *Myomyrus macrops* Boul. Faradje. Total length 265 mm.
Fig. 4. *Mormyrus caballus* Boul. Faradje. Total length 480 mm.

Plate LXV.

Fig. 1. *Gnathonemus monteiri* (Günth.). Faradje. Total length 440 mm.
Fig. 2. *Gnathonemus petersii* (Günth.). Rungu. Total length 323 mm.
Fig. 3. *Gnathonemus tamandua* (Günth.). Faradje. Total length 263 mm.
Fig. 4. *Gnathonemus rhynchophorus* Boul. Faradje. Total length 375 mm.

Plate LXVI.

Fig. 1. *Hydrocyon lineatus* Bleek. Faradje. Total length 270 mm.
Fig. 2. *Distichodus affinis* Günth. Faradje. Total length 120 mm.
Fig. 3. *Mesoborus crocodilus* Pell. Rungu. Total length 234 mm. Same specimen as Plate LXXI. Fig. 2.
Fig. 4. *Phago boulengeri* Schilt. Faradje. Total length 93 mm.

Plate LXVII.

Fig. 1. *Alestes macrophthalmus* Günth. Faradje. Total length 375 mm.
Fig. 2. *Bryconæthiops microstoma* Günth. Faradje. Variety *yseuxi*. Total length 140 mm.
Fig. 3. *Citharinus gibbosus* Boul. Faradje. Total length 460 mm. Lateral and dorsal views.

Plate LXVIII.

Fig. 1. *Sarcodaces odoë* (Bloch). Faradje. Total length 280 mm.
Fig. 2. The same with mouth open. Rungu.
Fig. 3. *Eugnathichthys macroterolepis* Boul. Faradje. Total length 125 mm.
Fig. 4. *Eugnathichthys eetveldii* Boul. Poko. Total length 283 mm.

Plate LXIX.

Distichodus langi sp. nov. Faradje. Total length 560 mm.

PLATE LXX.

Fig. 1. *Hydrocyon lineatus* Bleek. Faradje. Total length 610 mm. To show mouth open.

Fig. 2. *Heterobranchus longifilis* C. & V. Faradje. To show accessory respiratory organs (R).

PLATE LXXI.

Fig. 1. *Ophiocephalus obscurus* Günth. Rungu. To show open mouth. Total length 350 mm. Same specimen as Plate LXXXIII. Fig. 2.

Fig. 2. *Mesoborus crocodilus* Pell. Rungu. To show open mouth. Same specimen as Plate LXVI. Fig. 3.

Fig. 3. *Labeo macrostoma* Boul. Rungu. To show open mouth. Same specimen as Plate LXXIV.

PLATE LXXII.

Fig. 1. *Barbus fasolt* Papp. Faradje. Total length 755 mm.

Fig. 2. Same specimen showing details of head with mouth open.

PLATE LXXIII.

Labeo longipinnis Boul. Rungu. Total length 695 mm.

PLATE LXXIV.

Labeo macrostoma Boul. Rungu. Total length 837 mm. Same specimen as Plate LXXI. Fig. 3.

PLATE LXXV.

Fig. 1. *Labeo greenii* Boul. Faradje. Two specimens. Total length of upper specimen 380 mm. Total length of lower specimen 390 mm.

Fig. 2. *Labeo chariensis* Pell. Faradje. Total length 300 mm.

Fig. 3. *Auchenoglanis occidentalis* (C. & V.). Faradje. Total length 230 mm.

PLATE LXXVI.

Fig. 1. *Heterobranchus longifilis* C. & V. Faradje. Total length 980 mm.

Fig. 2. *Synodontis pleurops* Boul. Faradje. Ventral and dorsal views. Total length of larger specimen 210 mm.

Fig. 3. *Euchilichthys dybowskii* (Vaill.). Faradje. Ventral view. Total length 115 mm.

PLATE LXXVII.

Fig. 1. *Malopterurus electricus* (Gmel.). Faradje. Total length 720 mm.

Fig. 2. *Chrysichthys wagenaari* Boul. Poko. Total length 290 mm.

PLATE LXXVIII.

Fig. 1. *Lates niloticus* (Linn.). Faradje. Total length 860 mm.

Figs. 2 & 3. *Pelmatochromis lateralis* Boul. Rungu. To show variation in depth in specimens of the same size. The figures are on the same scale. Total length of upper specimen 210 mm. Total length of lower specimen 248 mm.

PLATE LXXIX.

Fig. 1. *Tetrodon mbu* Boul. Faradje. Total length 110 mm.

Fig. 2. *Euchilichthys guentheri* (Schilt.) Stanleyville. Total length 550 mm. Lower view of head to show disk and mouth.

PLATE LXXX.

Fig. 1. *Tilapia melanopleura* Duméril, Avakubi. $\frac{7}{10}$.
Fig. 2. *Bryconæthiops microstoma* var. *boulengeri* Pellegr., Avakubi. $\frac{7}{10}$.
Fig. 3. *Distichodus lusosso* Schilthuis, Faradje. $\frac{3}{8}$.

PLATE LXXXI.

Fig. 1. *Barbus holotænia* Boul., Avakubi. $\frac{7}{10}$.
Fig. 2. *Labeo parvus* Boul., Avakubi. $\frac{7}{10}$.
Fig. 3. *Euchilichthys dybowskii* (Vaillant), Avakubi. $\frac{7}{10}$.
Fig. 4. *Synodontis decorus* Boul., Avakubi. $\frac{1}{2}$.

PLATE LXXXII.

Fig. 1. *Petrocephalus simus* Sauvage, Faradje. $\frac{1}{2}$. (Given as "*balleyi*" on plate.)
Fig. 2. *Micralestes altus* Boul., Avakubi. $\frac{4}{5}$.
Fig. 3. *Gnathonemus mirus* Boul., Faradje. $\frac{2}{5}$.

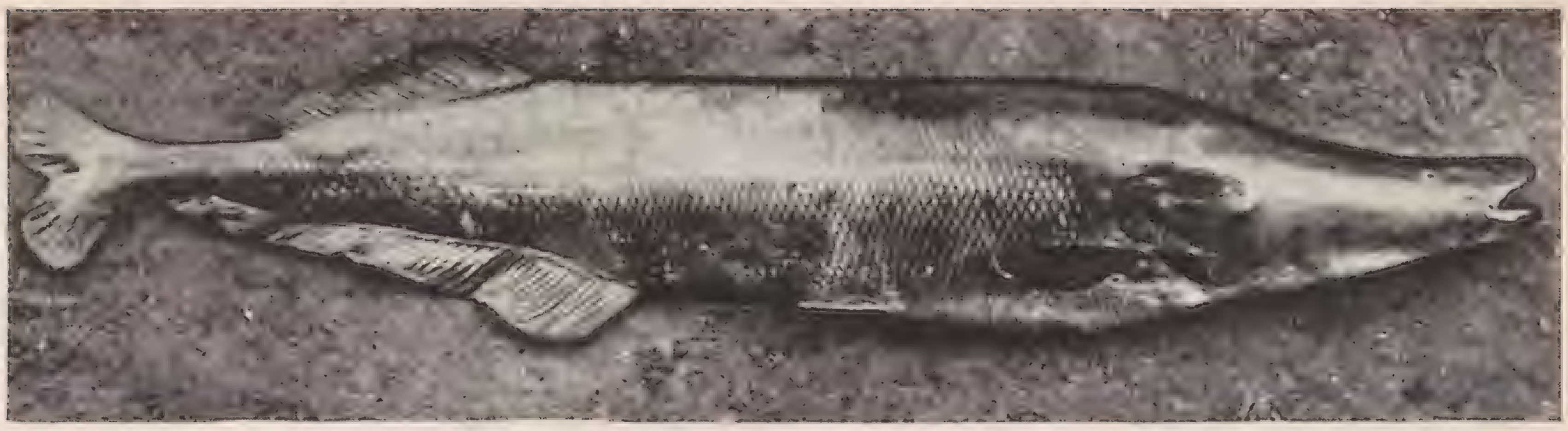
PLATE LXXXIII.

Fig. 1. *Mastacembelus congicus* Boul., Faradje. $\frac{2}{3}$.
Fig. 2. *Ophiocephalus obscurus* Boul., Faradje. $\frac{2}{3}$.
Fig. 3. *Polypterus ornatipinnis* Boul., Faradje. $\frac{1}{3}$.

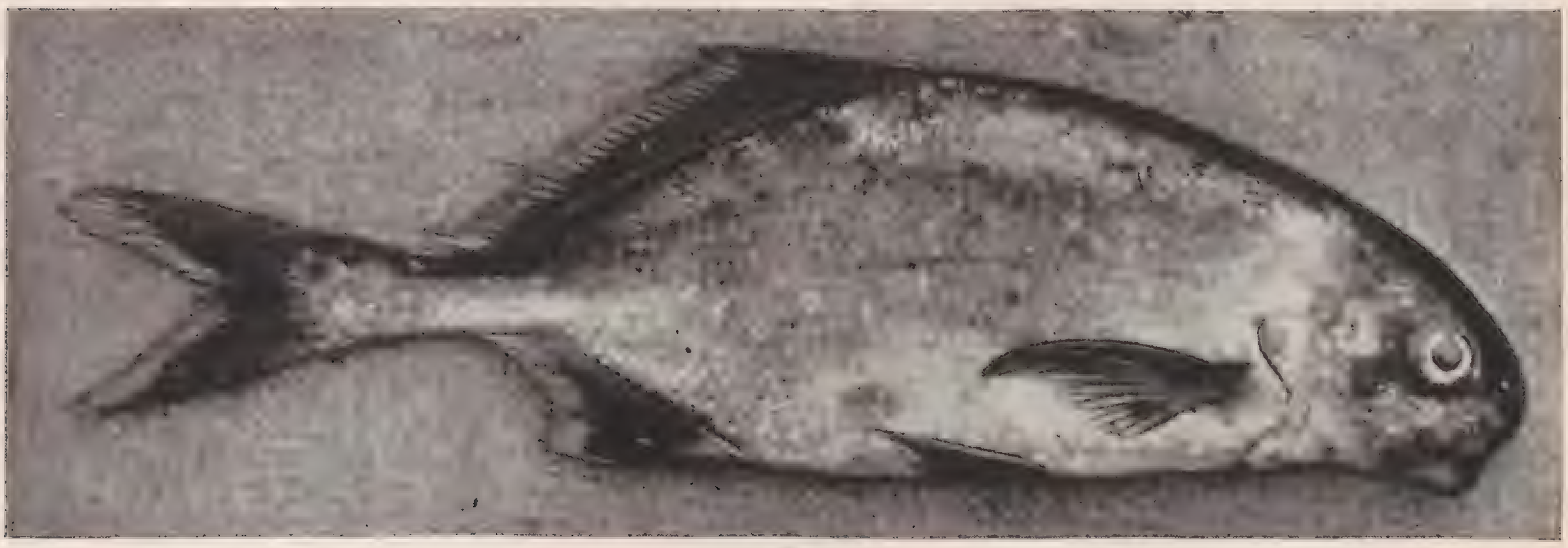
TEXT FIGURES.

Map 1. The Congo and Lake Region of Africa, showing all the localities where fishes were collected by the Congo Expedition, as well as some others mentioned in the present paper. The limits of the West African rain forest are indicated by a broken line . . . . p. 664
Map 2. Africa, indicating the divisions used in the discussion of the ichthyfauna . . . . p. 741
Map 3. Botanical Regions of Africa (after Engler) . . . . p. 744

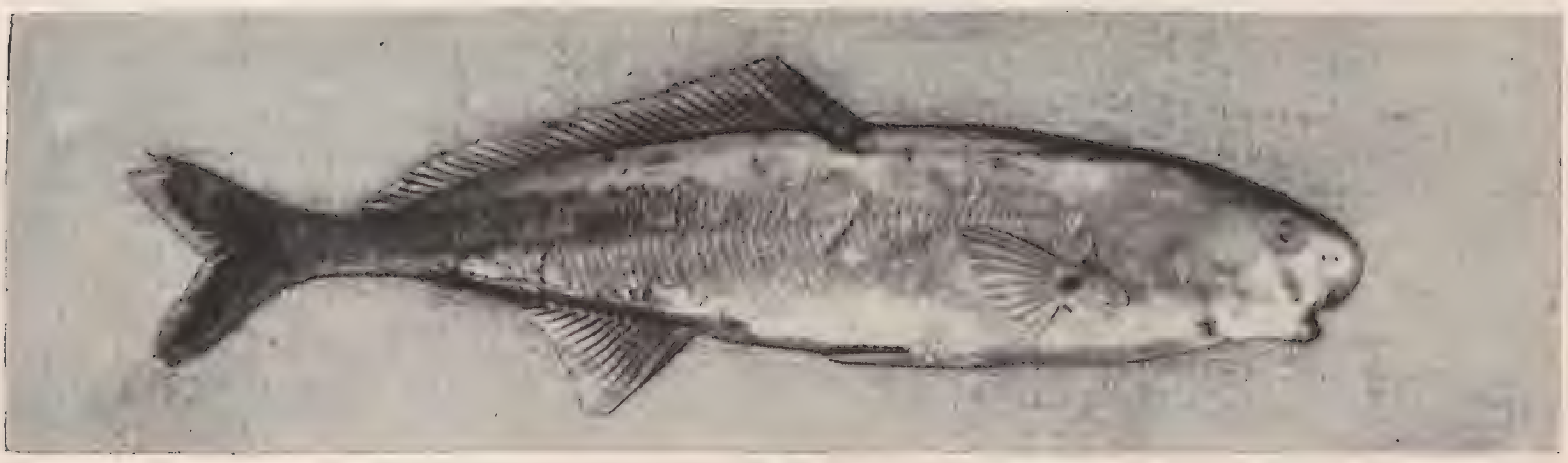
Fig. 1. *Marcusenius osborni*, type . . . . p. 668
Fig. 2. *Marcusenius retrodorsalis*, type . . . . p. 669
Fig. 3. *Pellonula tenuis*, type . . . . p. 675
Fig. 4. *Pellonula congica* (Regan) . . . . p. 676
Fig. 5. *Alestes carmesinus*, type . . . . p. 682
Fig. 6. *Microstomatichthyoborus bashforddeani*, type . . . . p. 685
Fig. 7. *Nannæthiops tritæniatus* (Boulenger) . . . . . . p. 686
Fig. 8. *Labeo cyclopinnis*, type . . . . p. 691
Fig. 9. *Labeo sorex*, type . . . . p. 692
Fig. 10. *Labeo intermedius*, type . . . . p. 694
Fig. 11. *Discognathus ornatus*, type . . . . p. 696
Fig. 12. *Barbus atromaculatus*, type . . . . p. 698
Fig. 13. *Barbus rubripinnis*, type . . . . p. 699
Fig. 14. *Barbus dolichosoma*, type . . . . p. 700
Fig. 15. *Barbus candens*, type . . . . p. 701
Fig. 16. *Barilius salmolucius*, type . . . . p. 703
Fig. 17. *Engraulicypris congicus*, type . . . . p. 704
Fig. 18. *Clarias zygouron*, type . . . . p. 705
Fig. 19. *Clarias malaris*, type . . . . p. 706
Fig. 20. *Eutropius gastratus*, type . . . . p. 709
Fig. 21. *Gnathobagrus depressus*, type . . . . p. 712
Fig. 22. *Amarginops platus*, type. Lateral view . . . . . p. 714
Fig. 23. *Amarginops platus*, type. Dorsal view . . . . . p. 714
Fig. 24. *Amphilius notatus*, type . . . . p. 715
Fig. 25. *Synodontis tenuis*, type . . . . p. 718
Fig. 26. *Acanthocleithron chapini*, type . . . . p. 721
Fig. 27. *Doumea alula*, type . . . . p. 722
Fig. 28. *Haplochilus platysternus*, type . . . . p. 724
Fig. 29. *Paratilapia longipinnis*, type . . . . p. 728
Fig. 30. *Paratilapia xenodon*, type . . . . p. 729
Fig. 31. *Lamprologus obliquus*, type . . . . p. 732



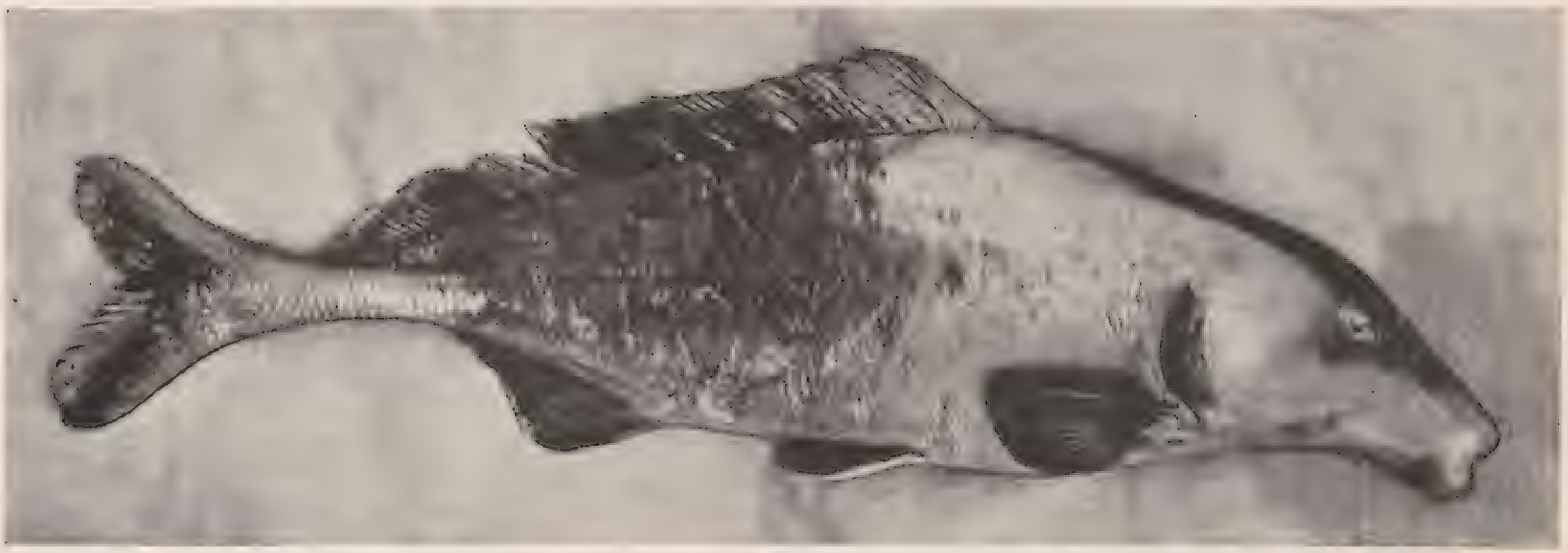
1



2

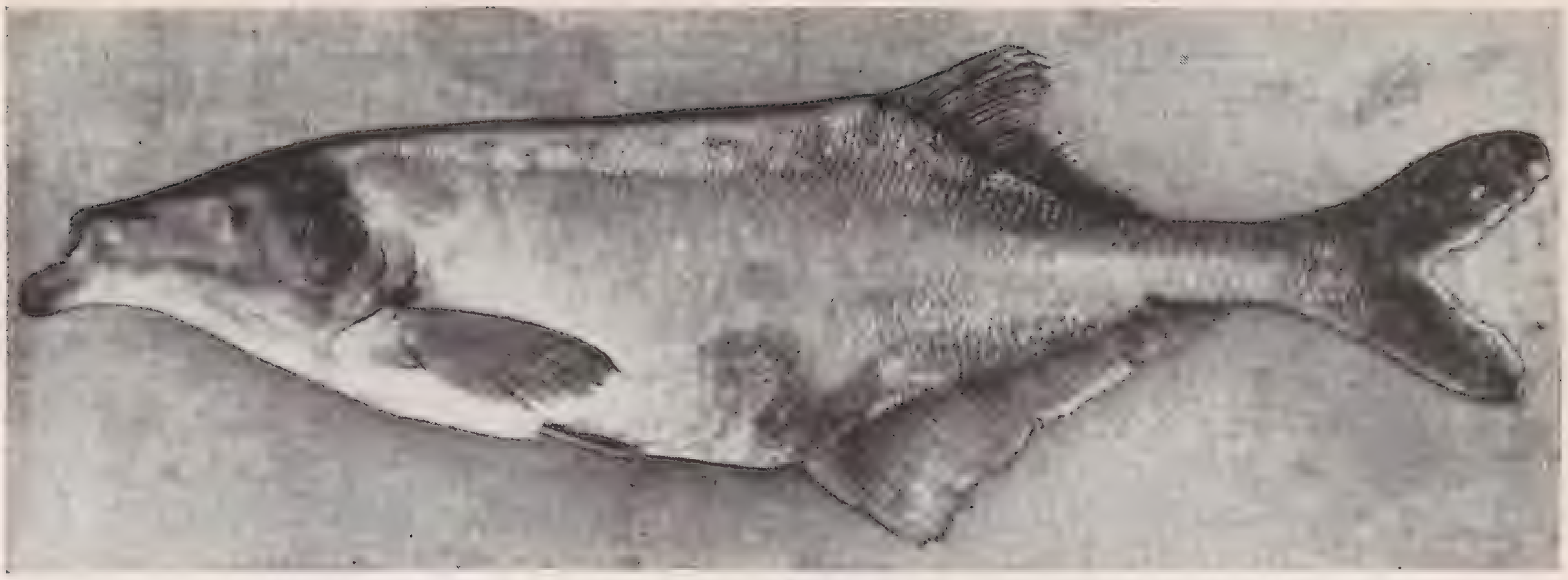


3

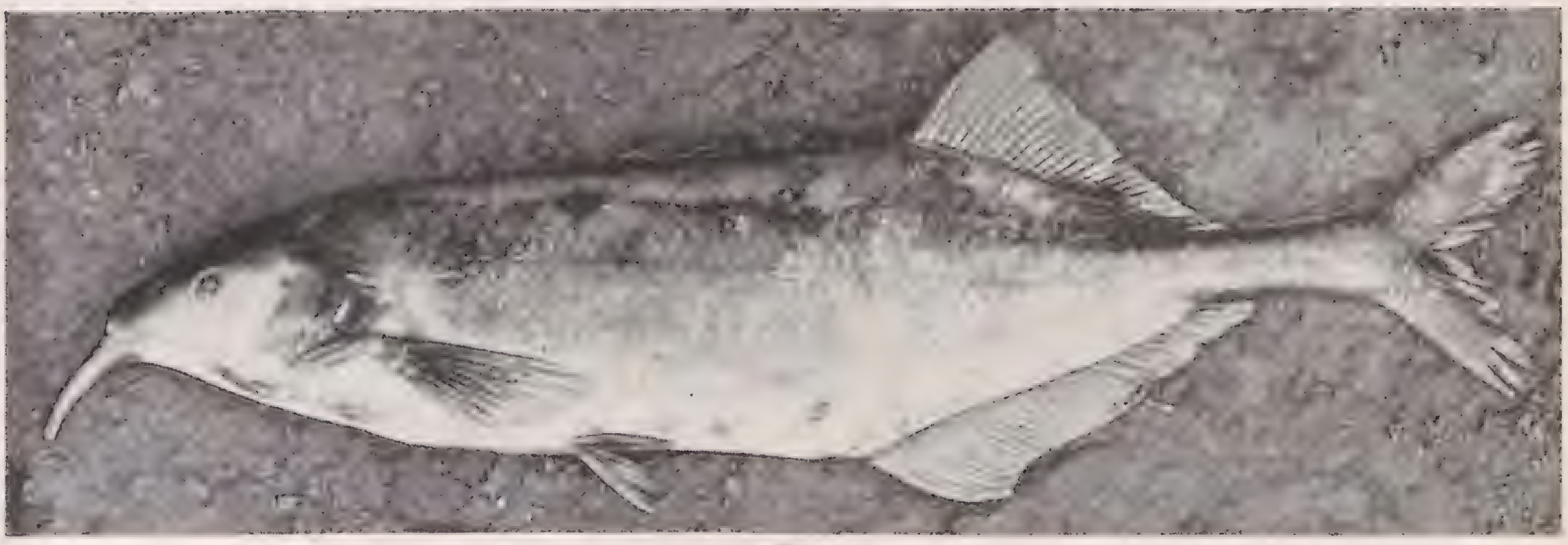


4

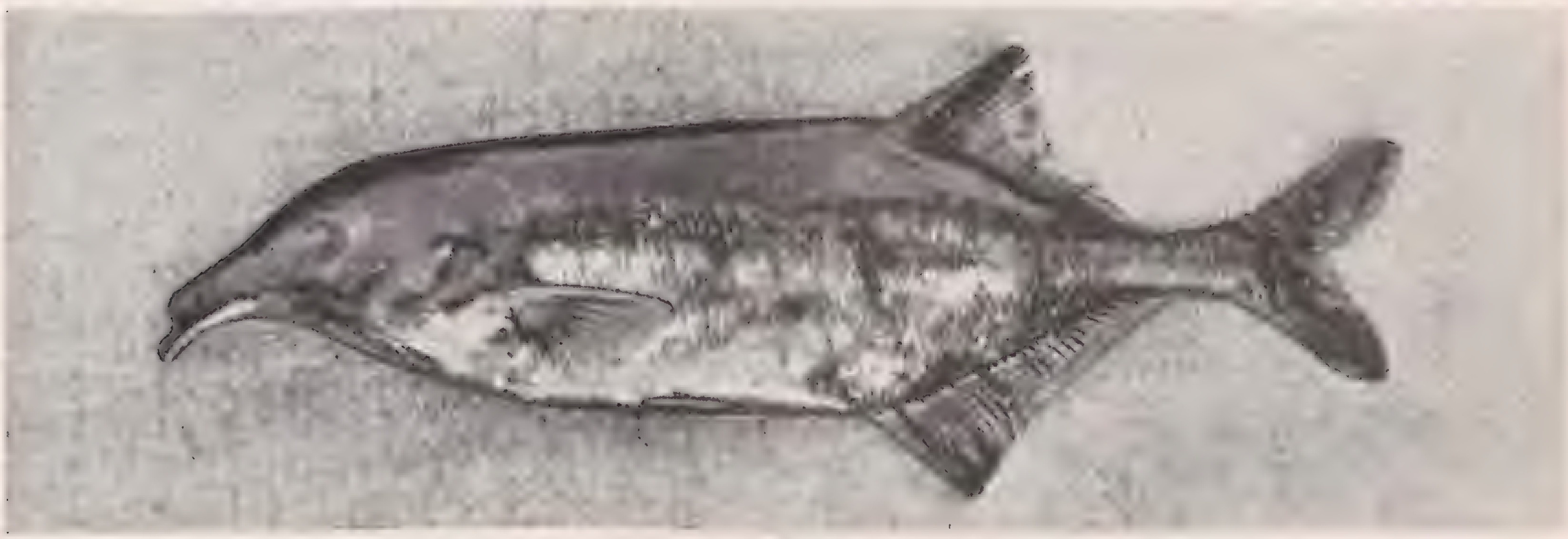
Fig. 1. Mormyrops deliciosus (Leach). Faradje. Total length 1060 mm.
Fig. 2. Marcusenius psittacus (Boul.). Faradje. Total length 185 mm.
Fig. 3. Myomyrus macrops Boul. Faradje. Total length 265 mm.
Fig. 4. Mormyrus caballus Boul. Faradje. Total length 480 mm.



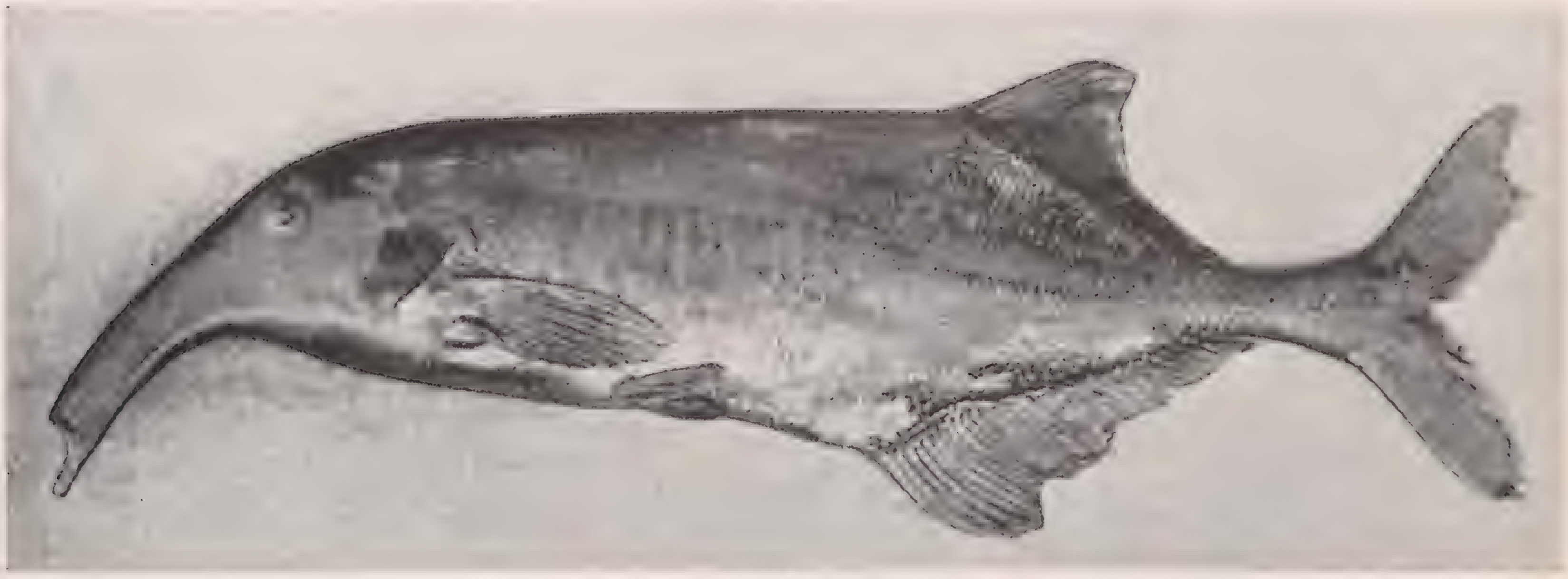
1



2

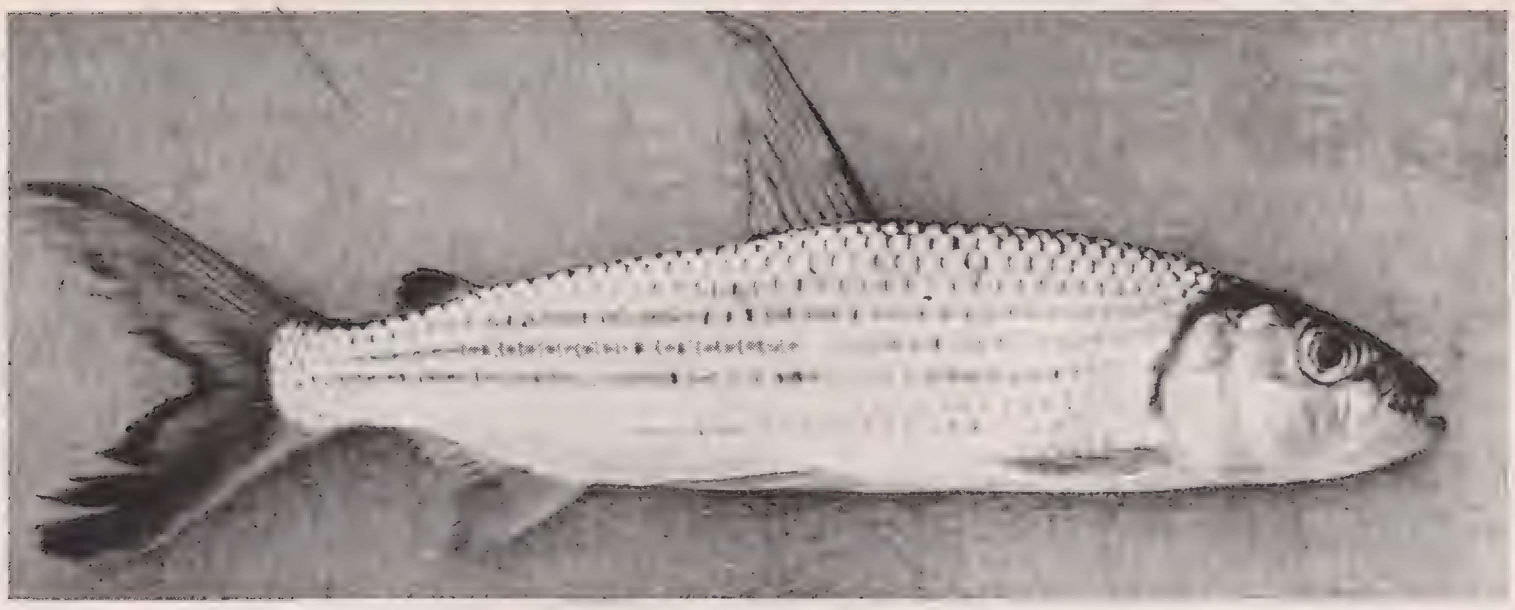


3

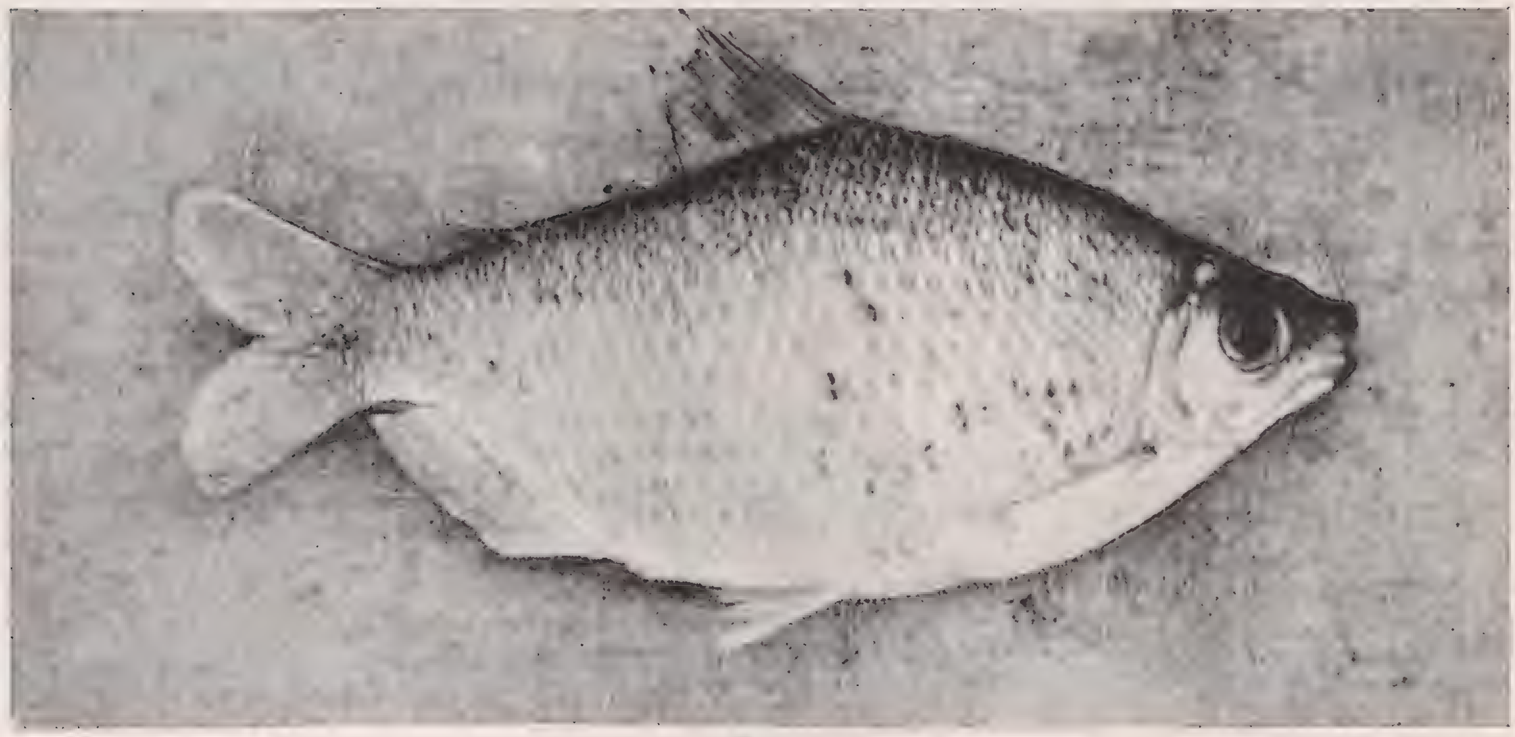


4

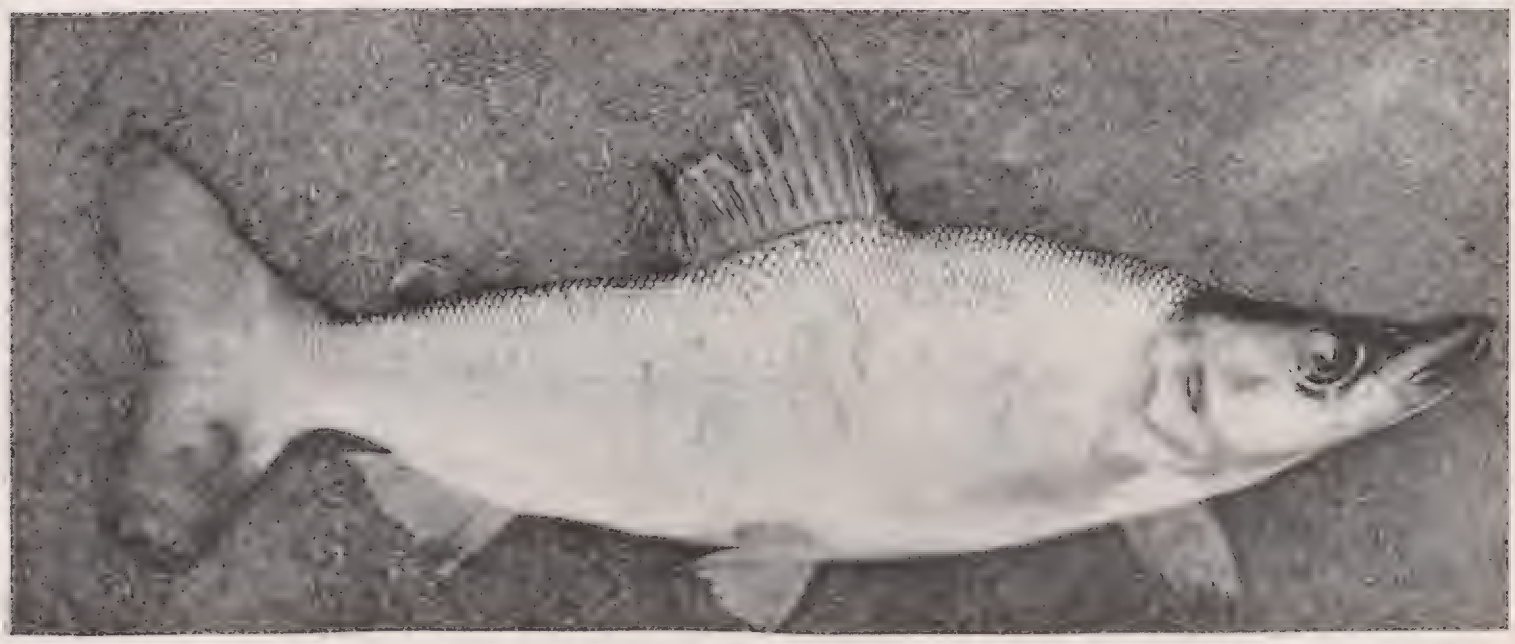
Fig. 1. Gnathonemus monteiri (Günth.). Faradje. Total length 440 mm.
Fig. 2. Gnathonemus petersii (Günth.). Rungu. Total length 323 mm.
Fig. 3. Gnathonemus tamandua (Günth.). Faradje. Total length 263 mm.
Fig. 4. Gnathonemus rhynchophorus Boul. Faradje. Total length 375 mm.



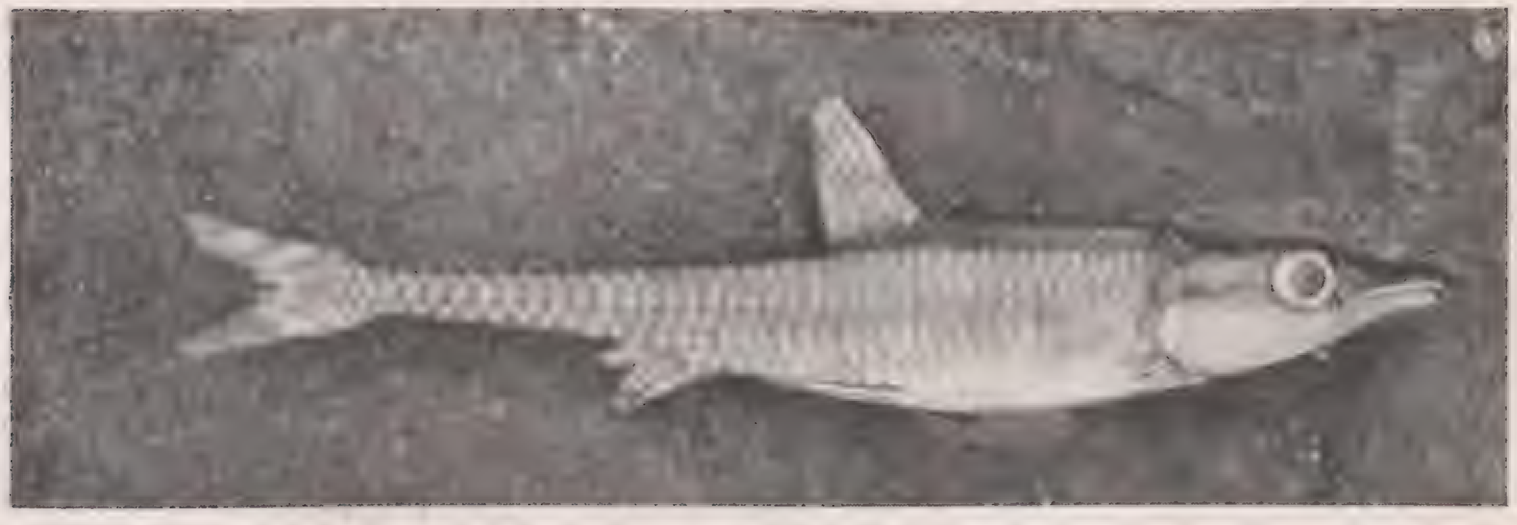
1



2

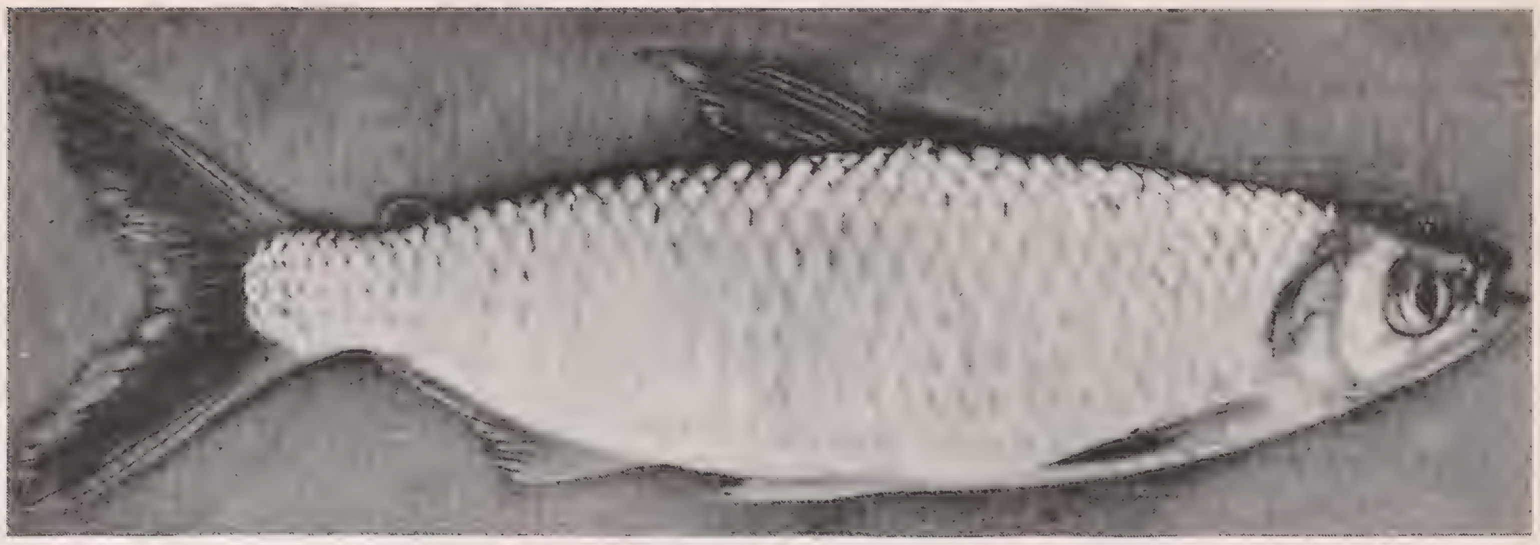


3

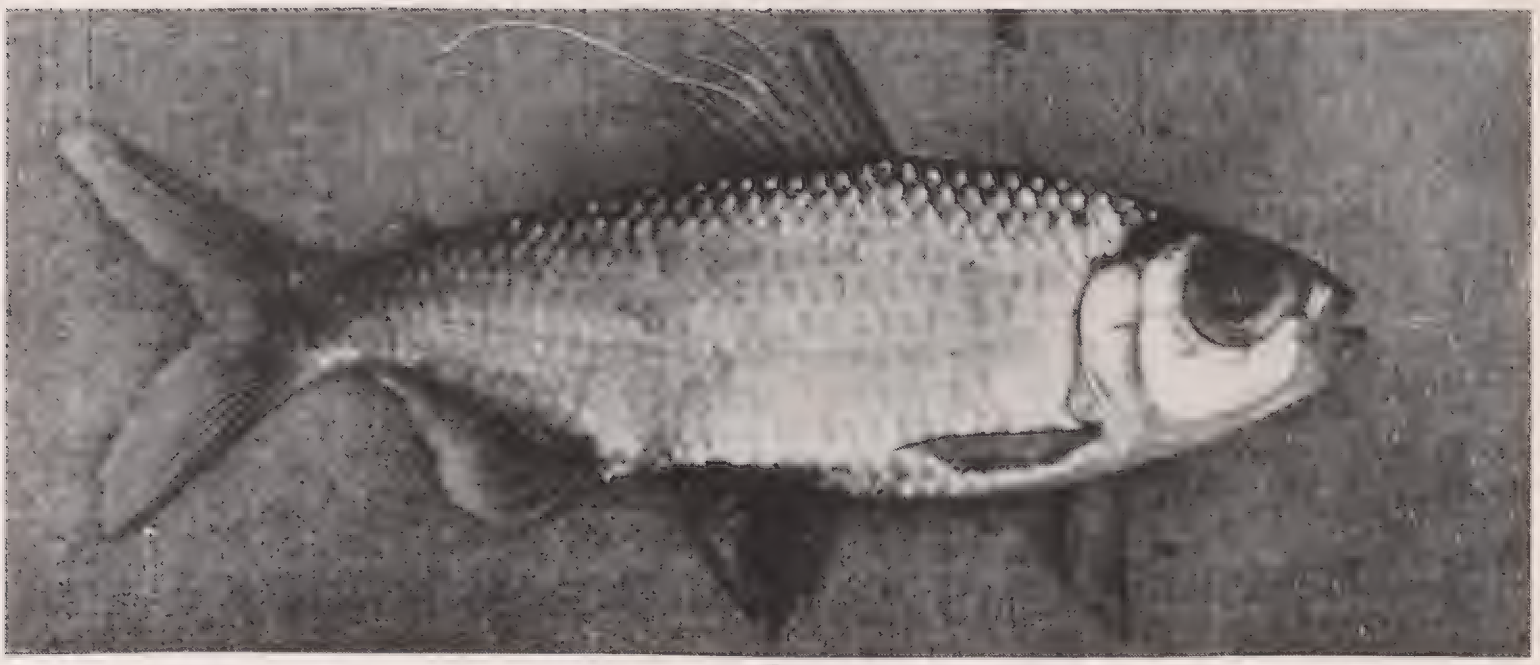


4

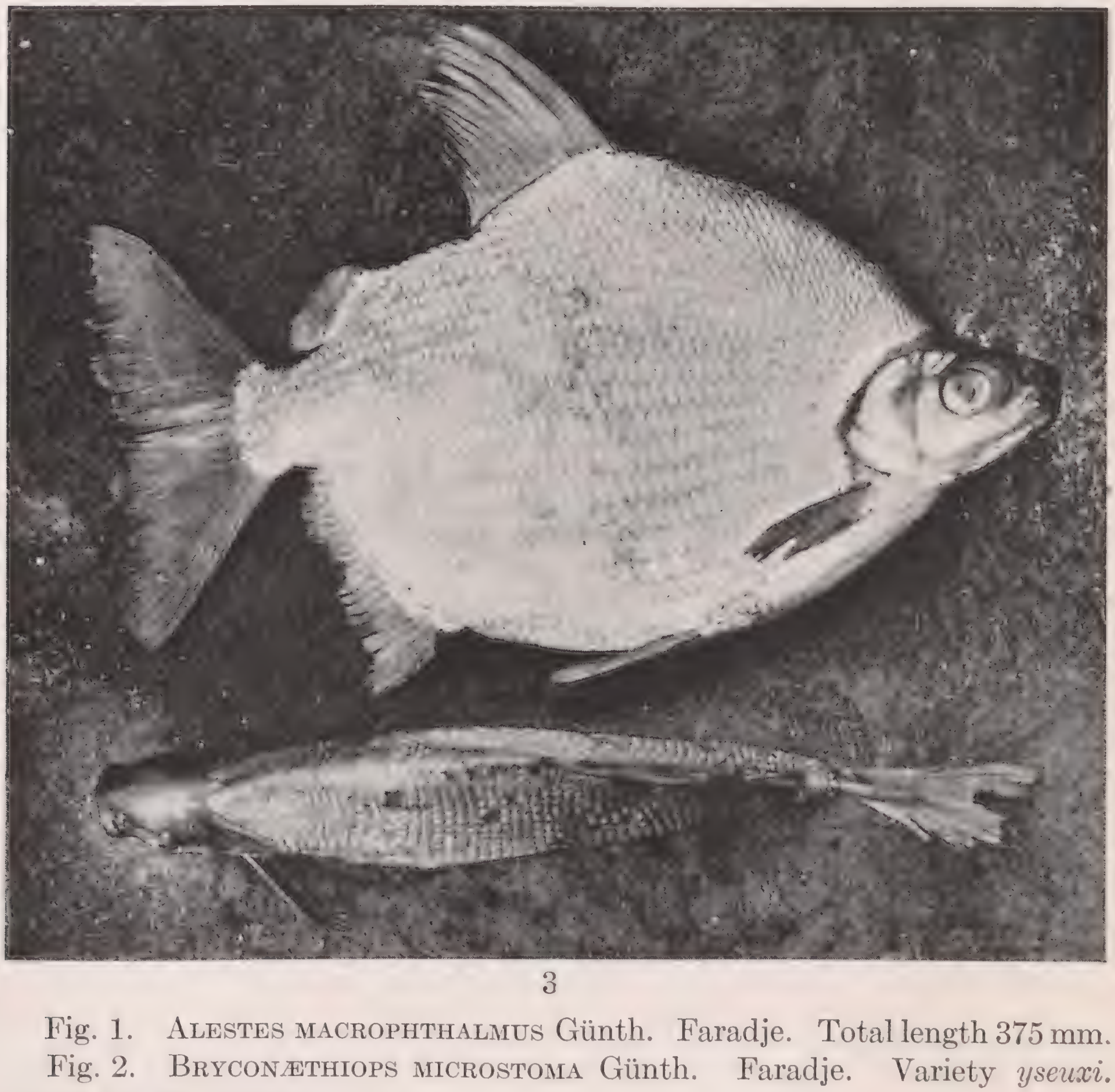
Fig. 1. Hydrocyon lineatus Bleek. Faradje. Total length 270 mm.
Fig. 2. Distichodus affinis Günth. Faradje. Total length 120 mm.
Fig. 3. Mesoborus crocodilus Pell. Rungu. Total length 234 mm. Same specimen as Plate LXXI, Fig. 2.
Fig. 4. Phago boulengeri Schilt. Faradje. Total length 93 mm.



1



2

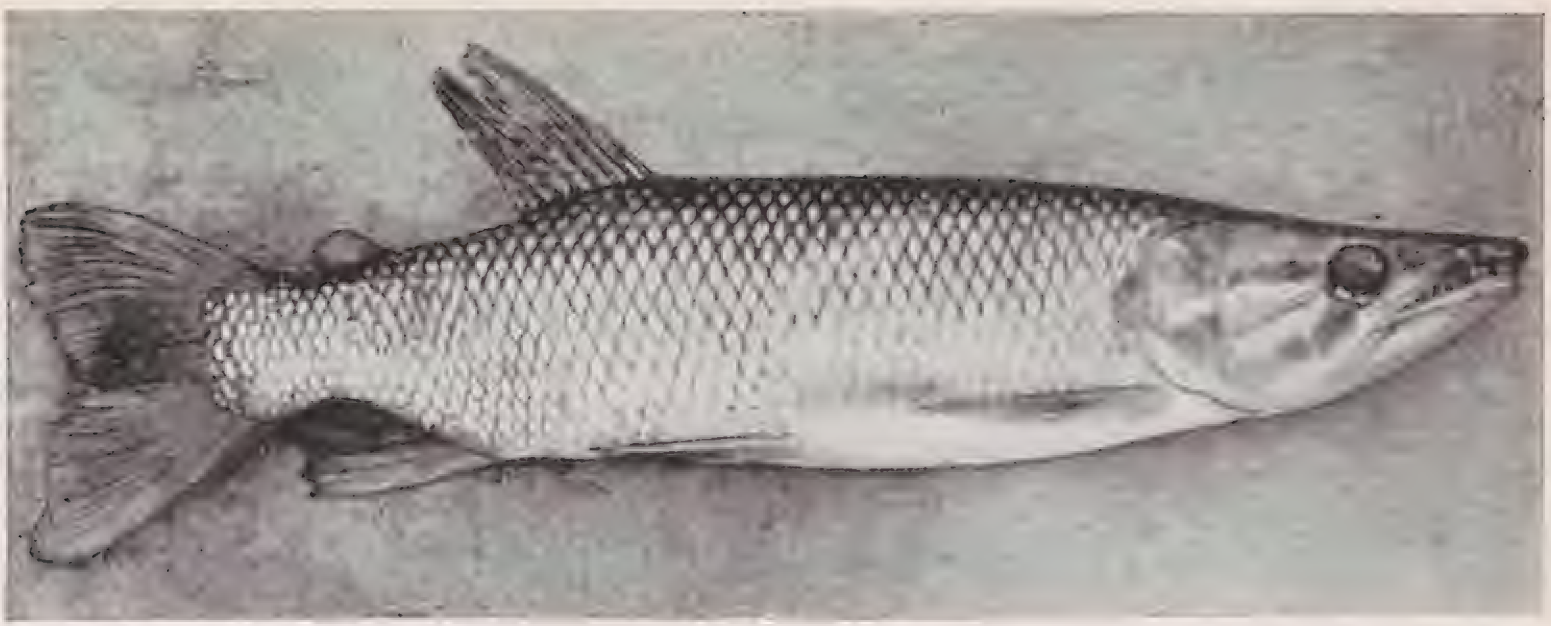


3

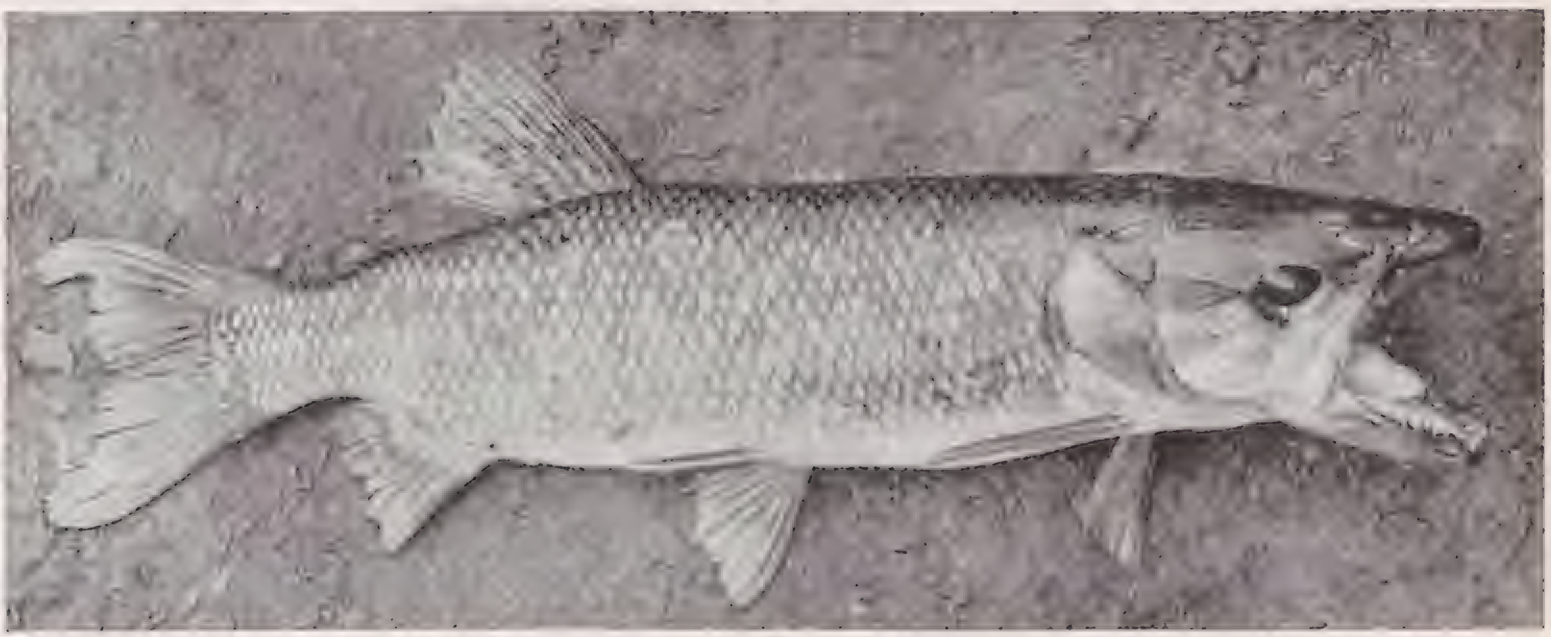
Fig. 1. ALESTES MACROPHTHALMUS Günth. Faradje. Total length 375 mm.

Fig. 2. BRYCONÆTHIOPS MICROSTOMA Günth. Faradje. Variety *yseuxi*. Total length 140 mm.

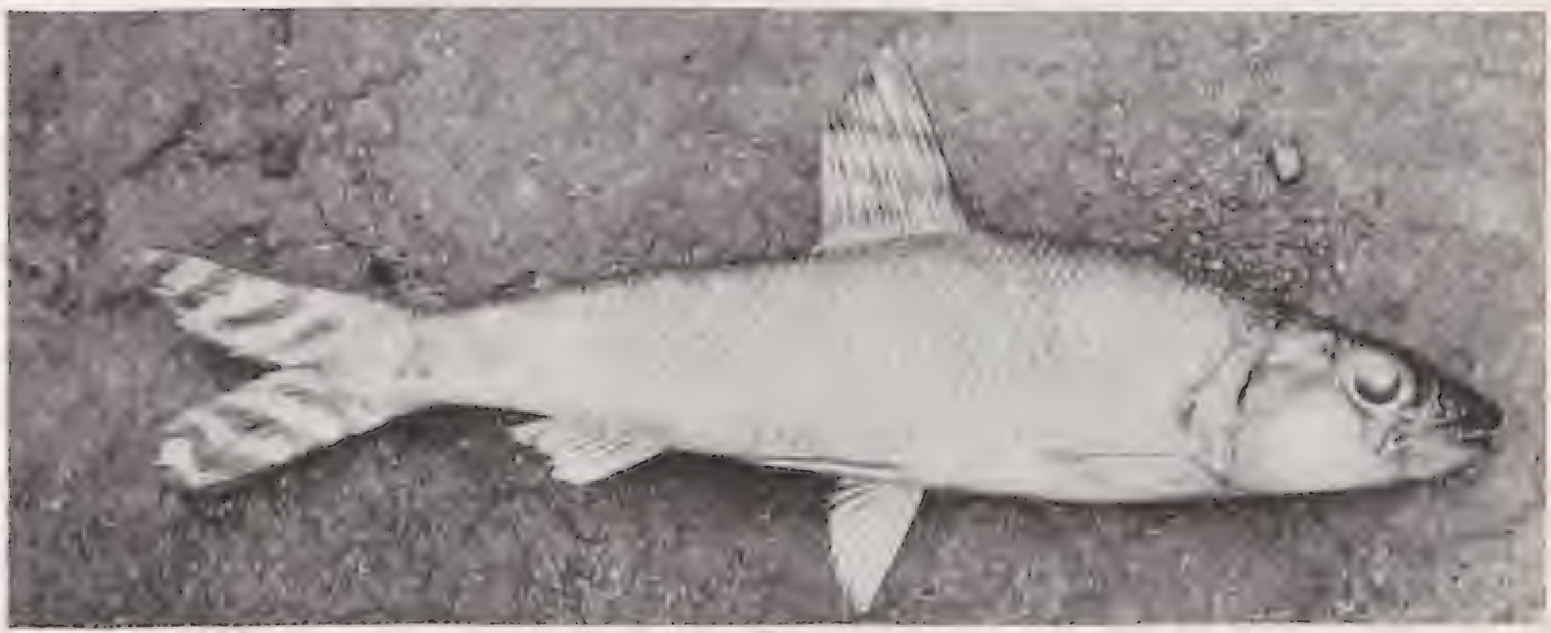
Fig. 3. CITHARINUS GIBBOSUS Boul. Faradje. Total length 460 mm. Lateral and dorsal views.



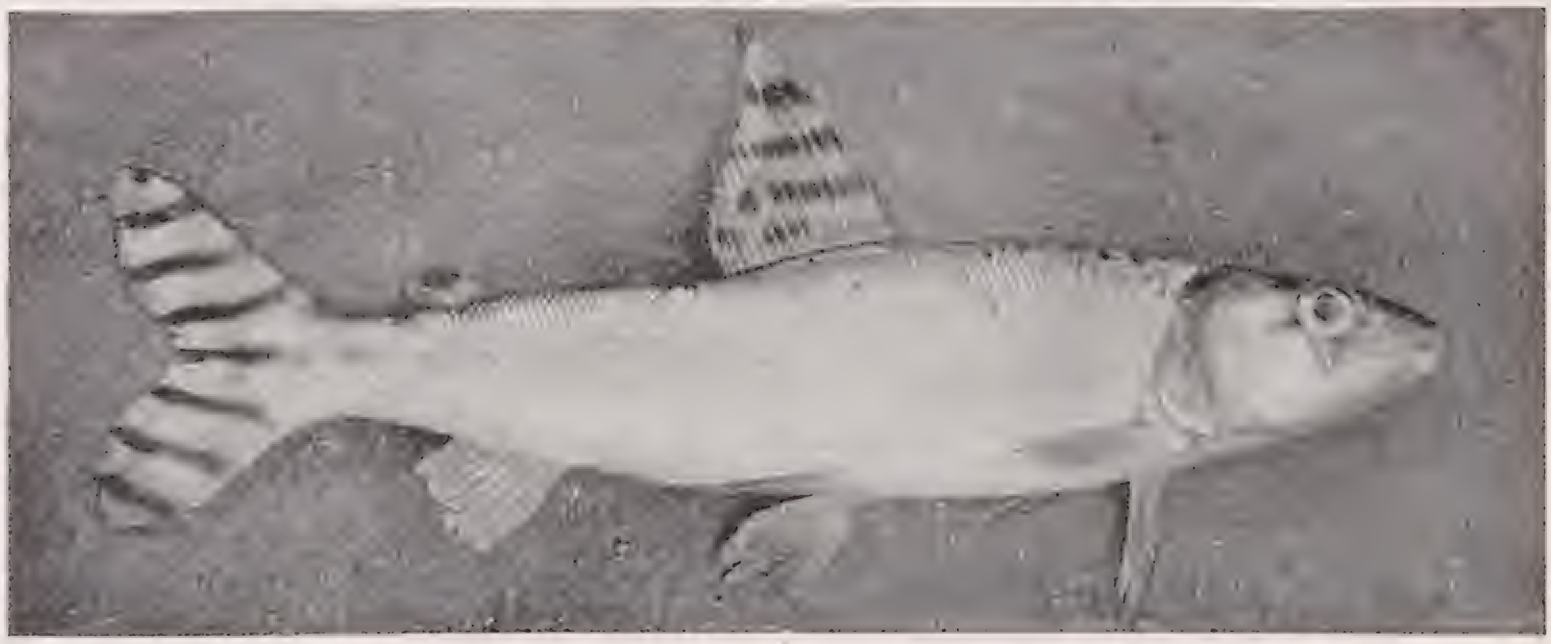
1



2

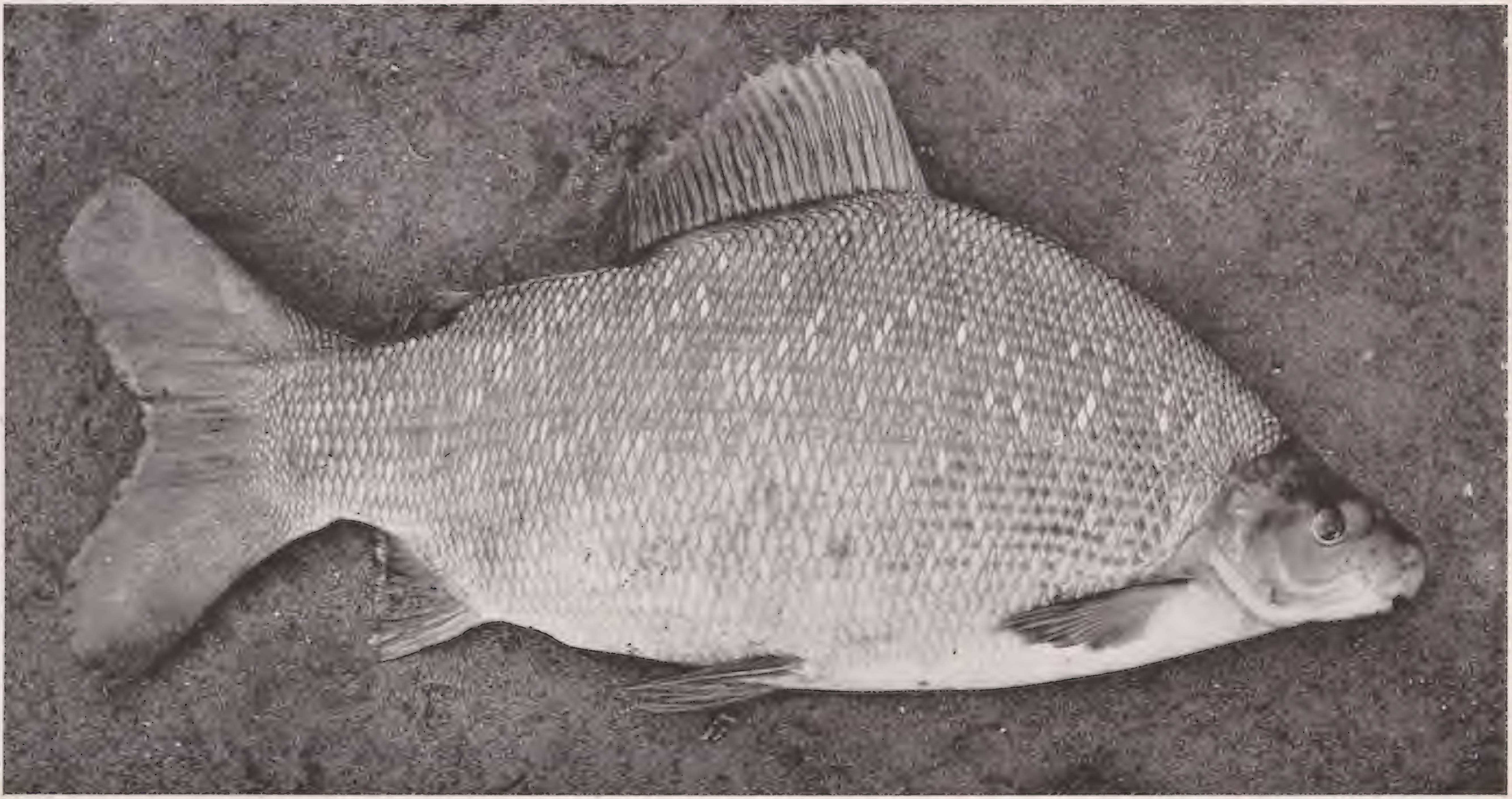


3

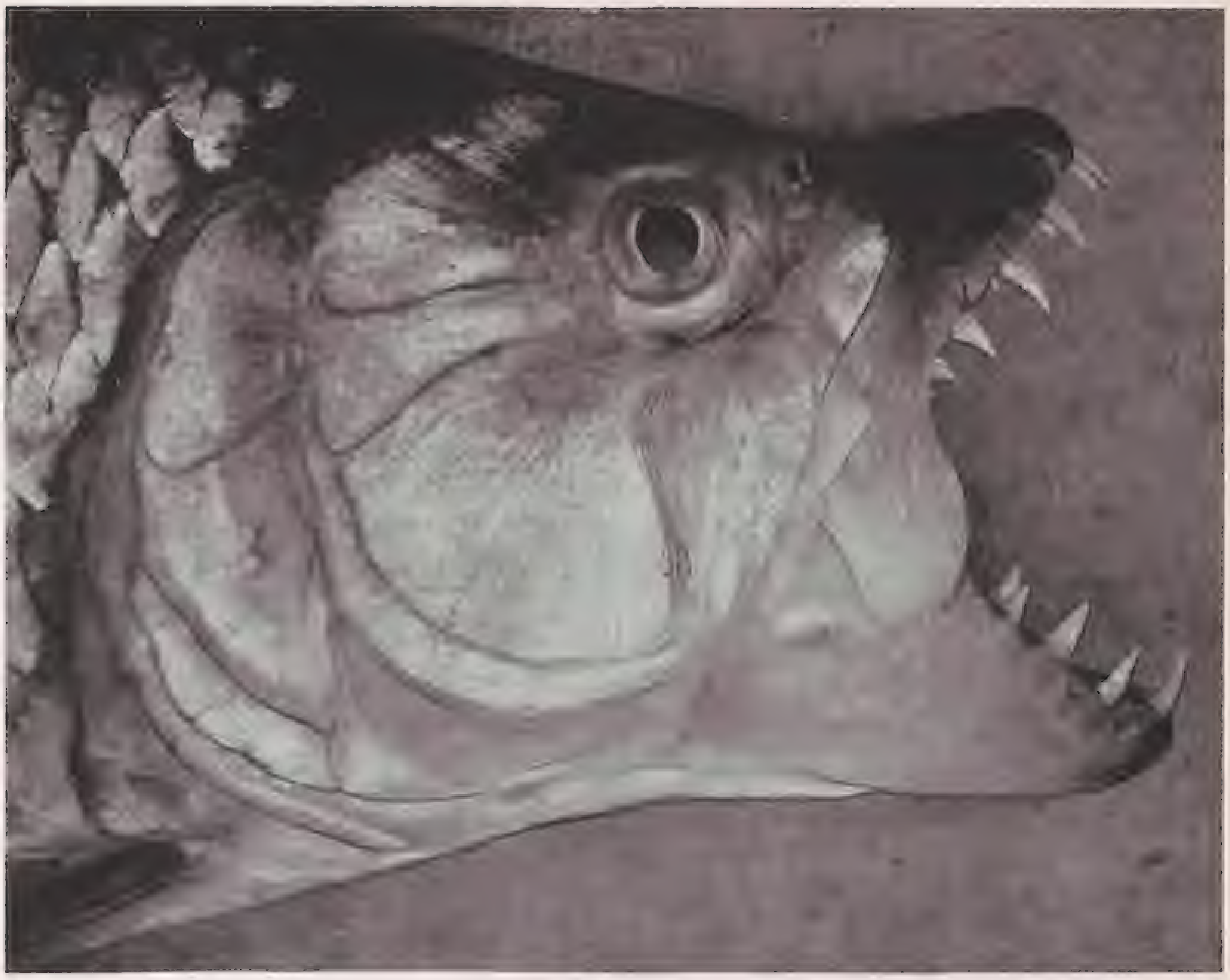


4

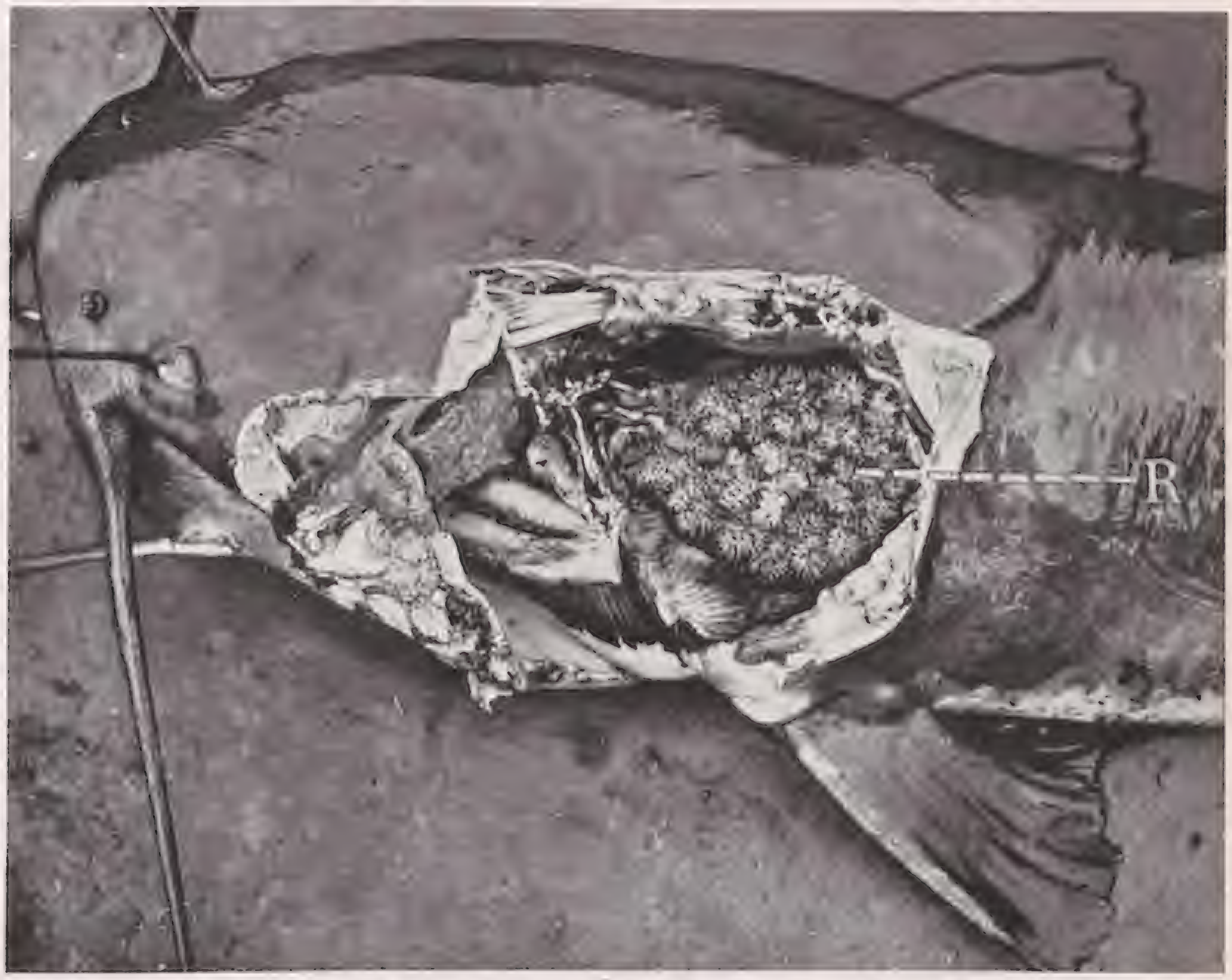
Fig. 1. Sarcodaces odoë (Bloch). Faradje. Total length 280 mm.
Fig. 2. The same with mouth open. Rungu.
Fig. 3. Eugnathichthys macroterolepis Boul. Faradje. Total length 125 mm.
Fig. 4. Eugnathichthys eetveldii. Poko. Total length 283 mm.



DISTICHODUS LANGI sp. nov. Faradje. Total length 560 mm.



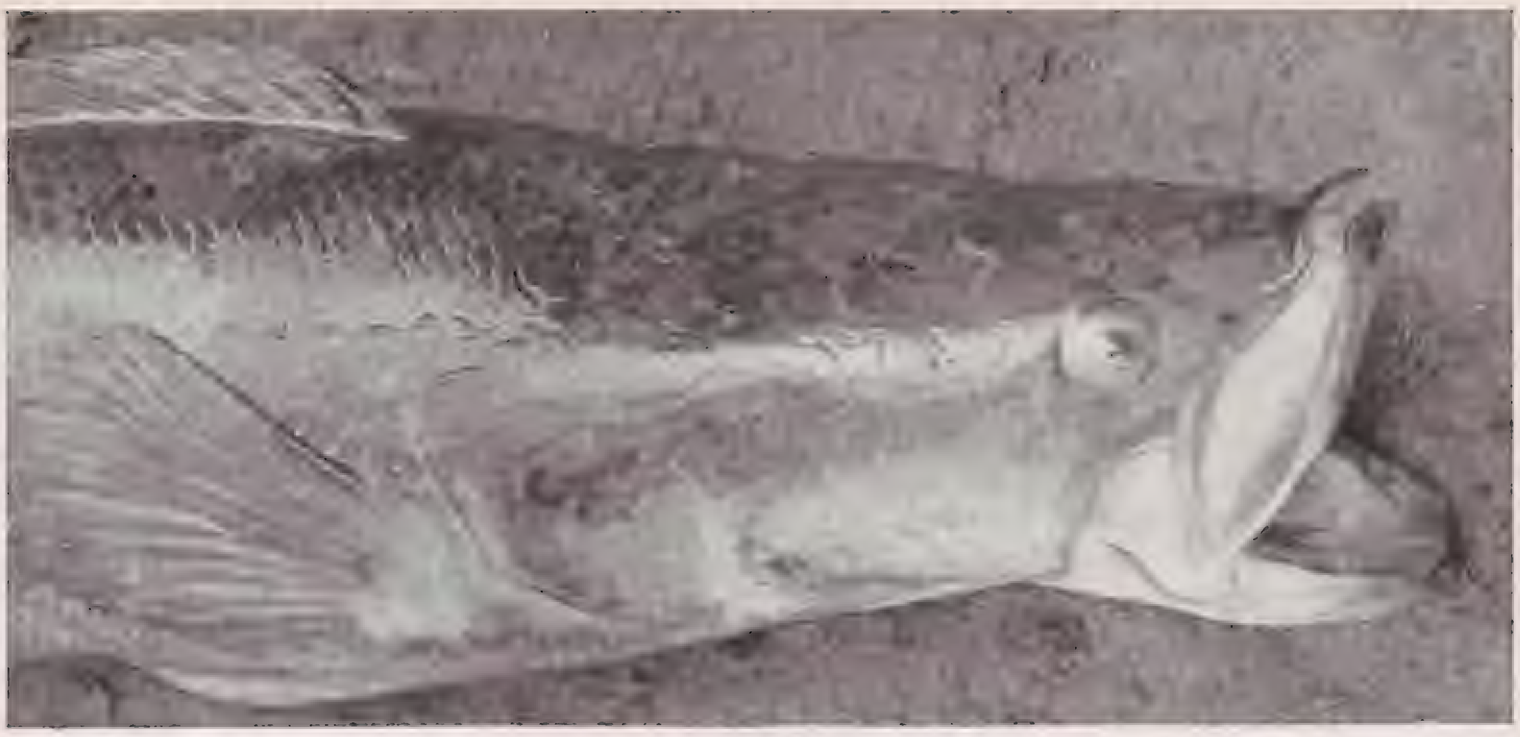
1



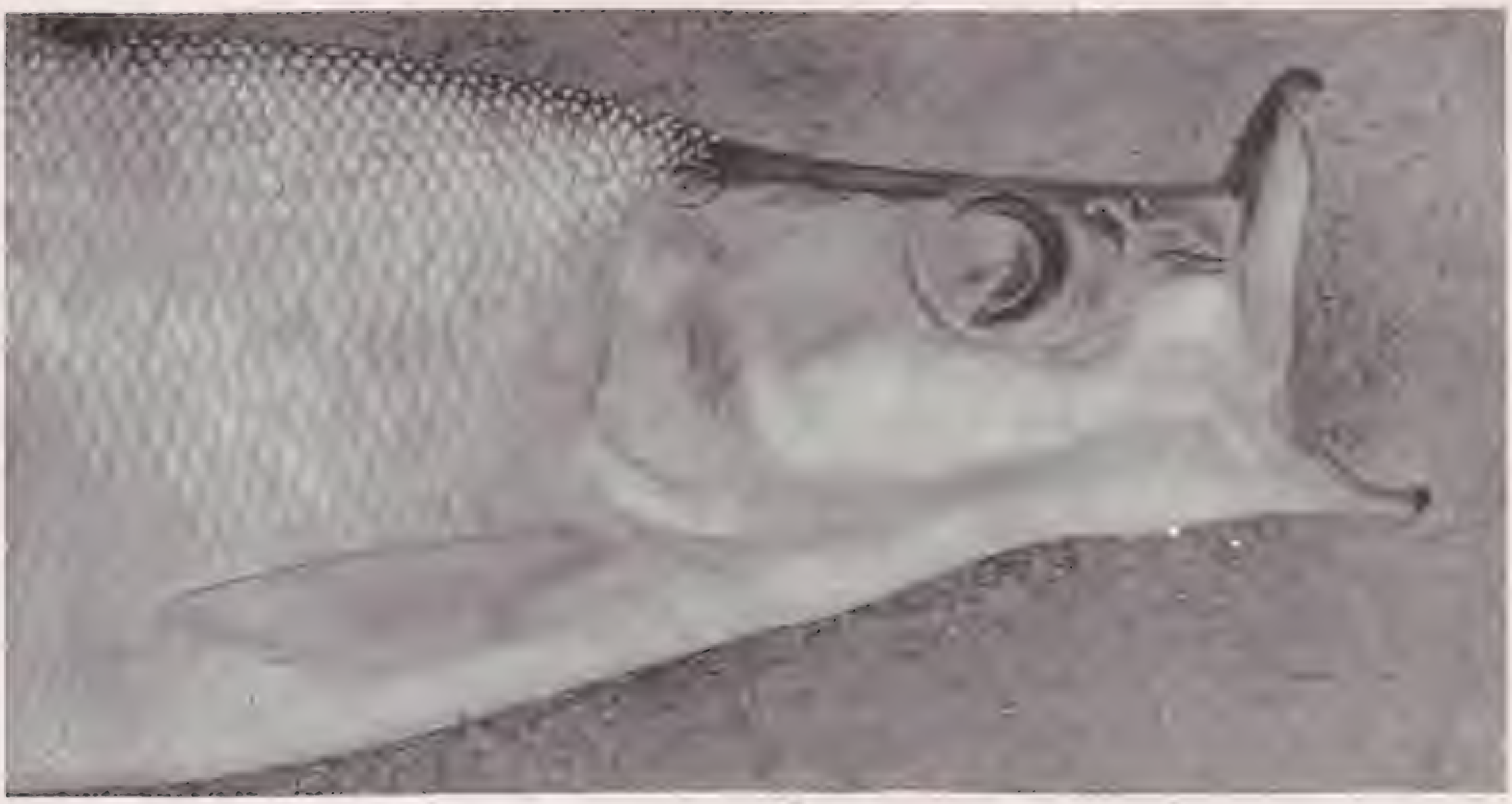
2

Fig. 1. Hydrocyon lineatus Bleek. Faradje. Total length 610 mm. To show mouth open.

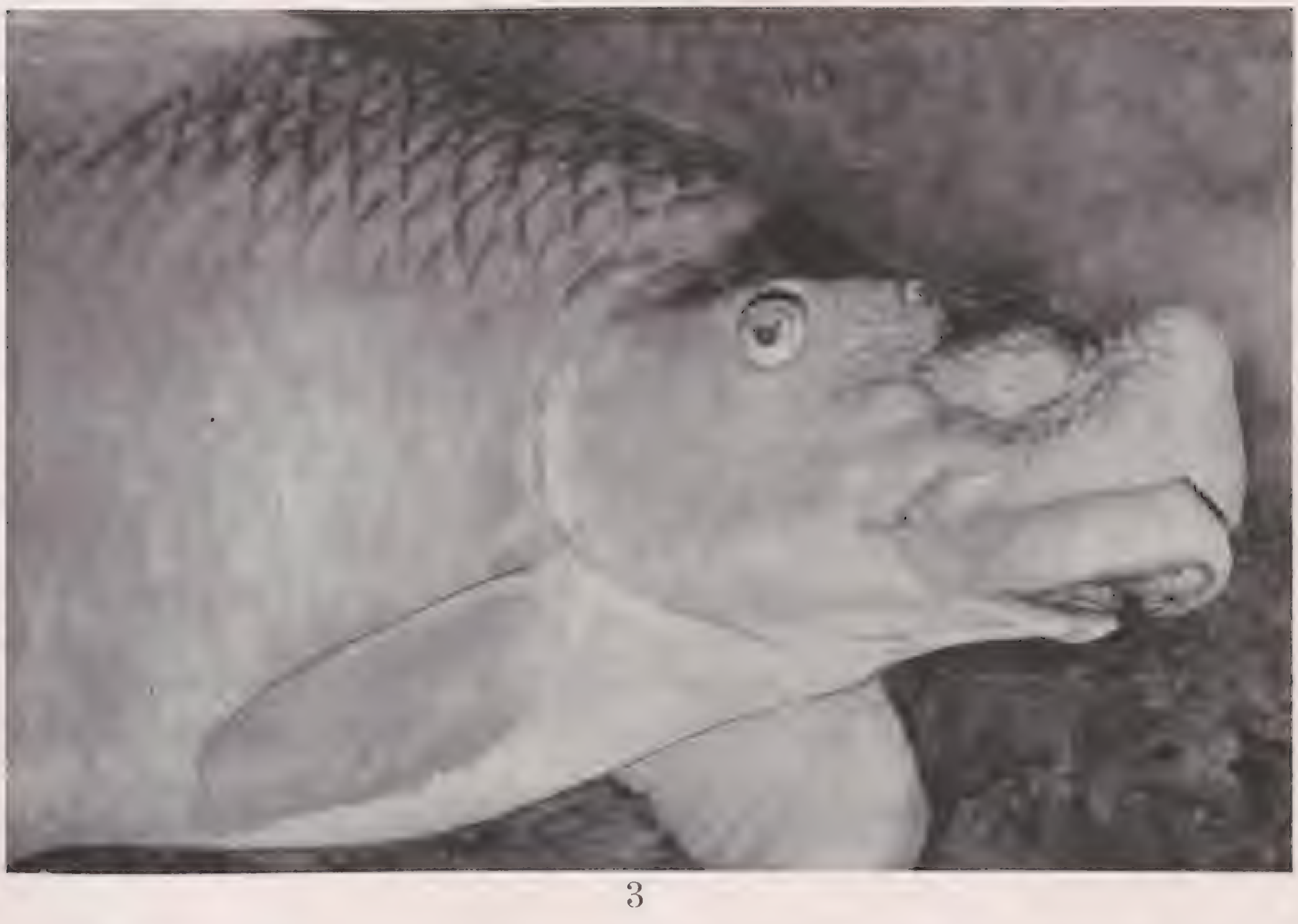
Fig. 2. Heterobranchus longifilis C. & V. Faradje. To show accessory respiratory organs (R).



1



2

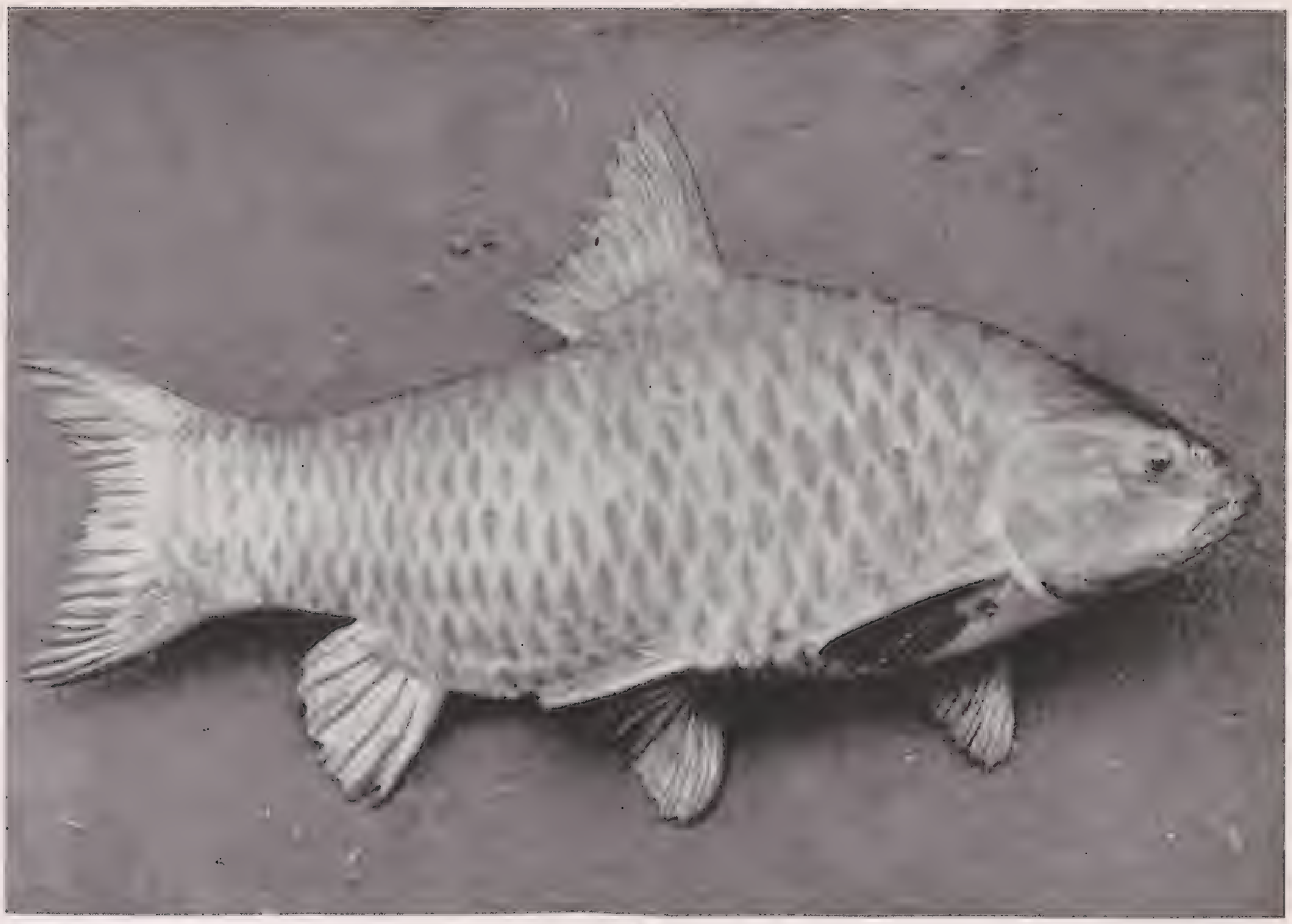


3

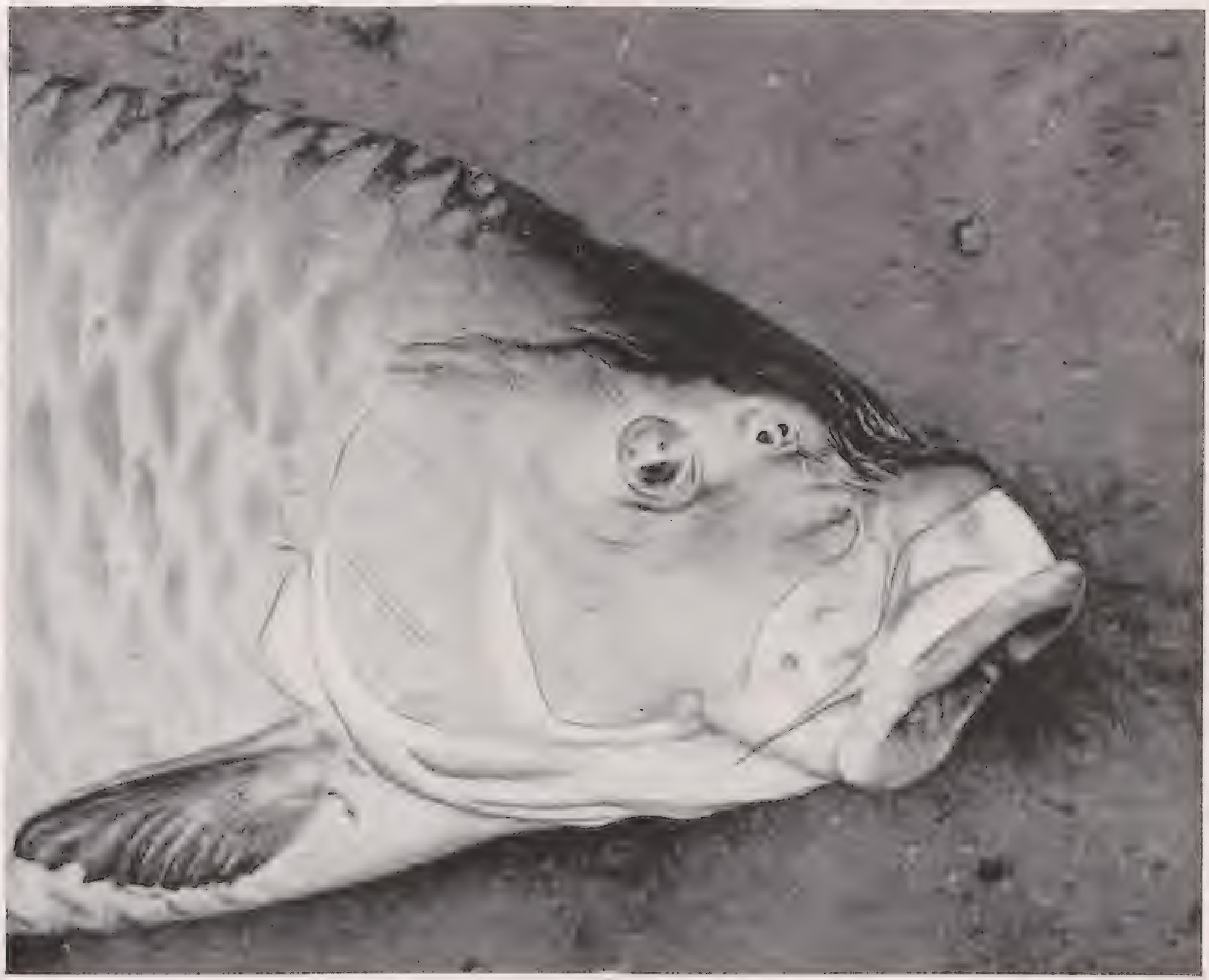
Fig. 1. OPHIOCEPHALUS OBSCURUS Günth. Rungu. To show open mouth. Total length 350 mm. Same specimen as Plate LXXXIII. Fig. 2.

Fig. 2. MESOBORUS CROCODILUS Pell. Rungu. To show open mouth. Same specimen as Plate LXVI, Fig. 3.

Fig. 3. LABEO MACROSTOMA Boul. Rungu. To show open mouth. Same specimen as Plate LXXIV.

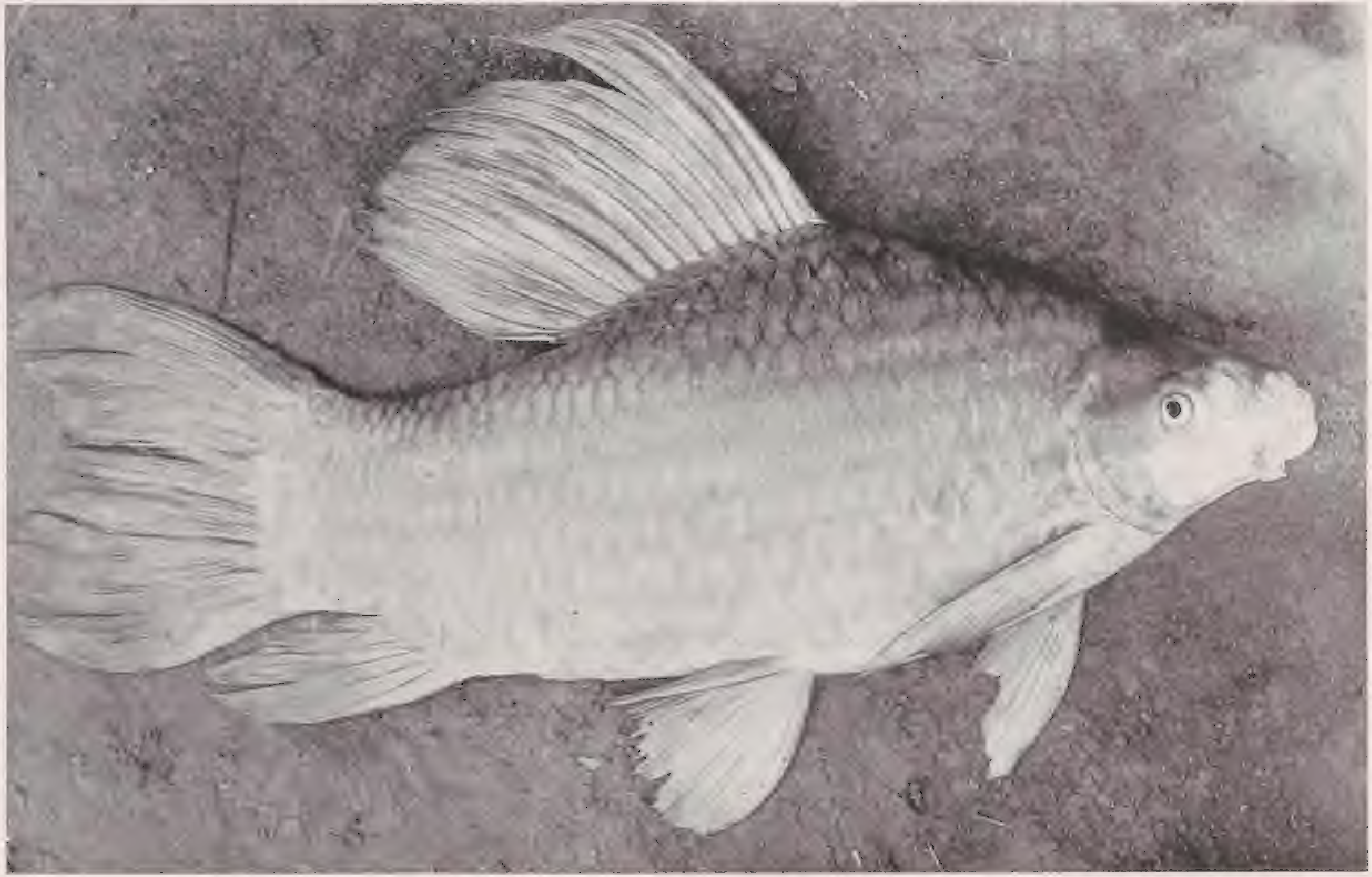


1

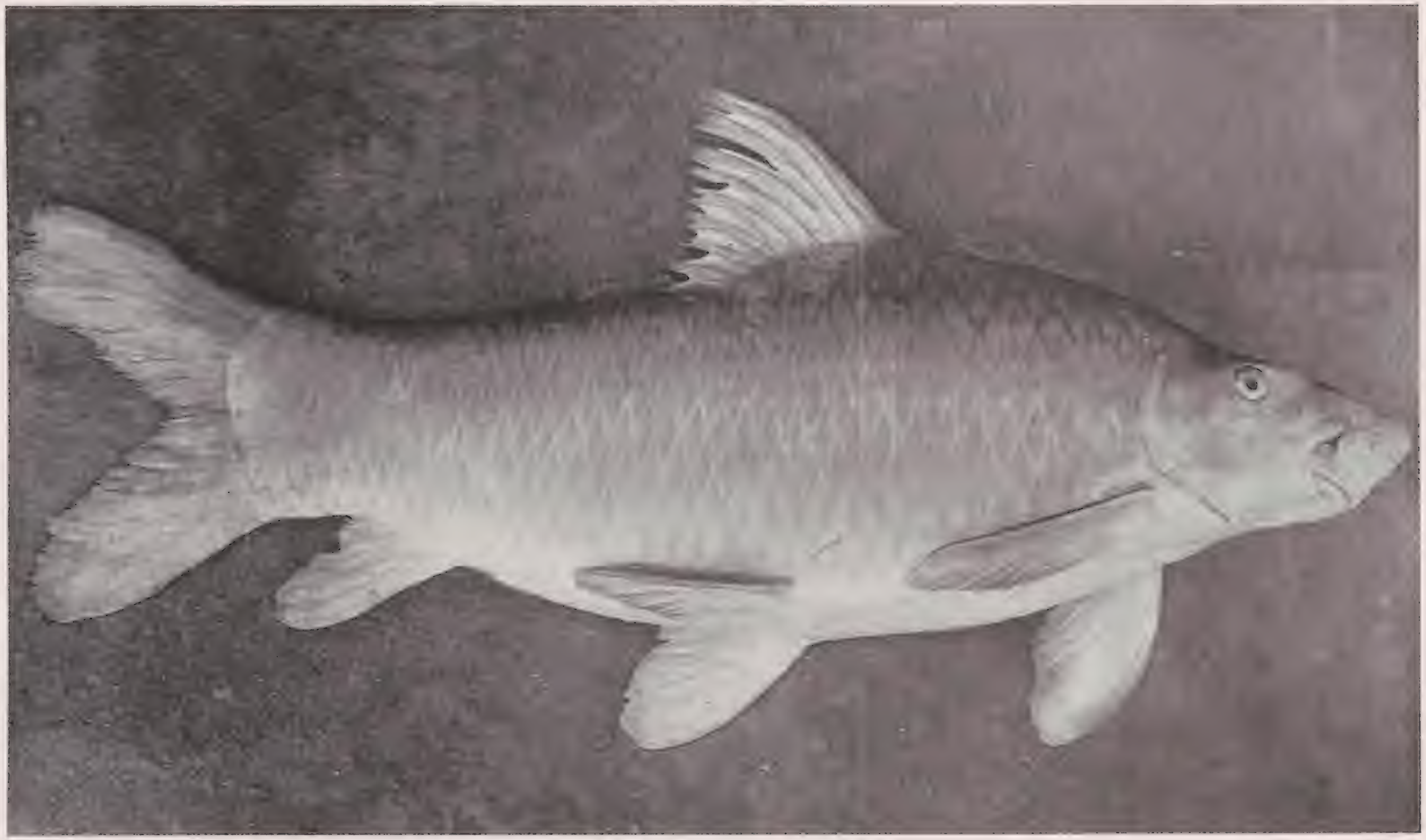


2

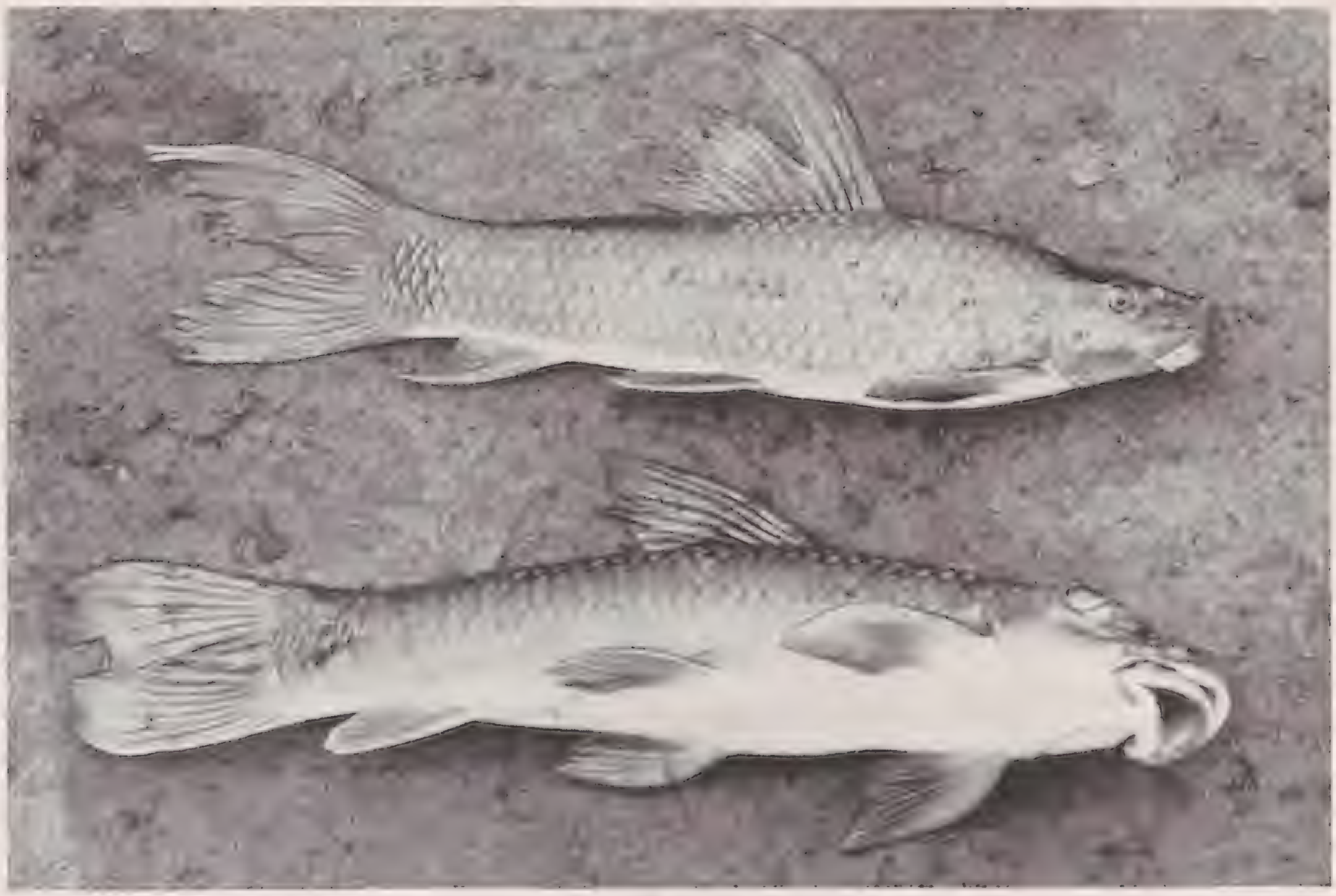
Fig. 1. BARBUS FASOLT Papp. Faradje. Total length 755 mm.
Fig. 2. Same specimen showing details of head with mouth open.



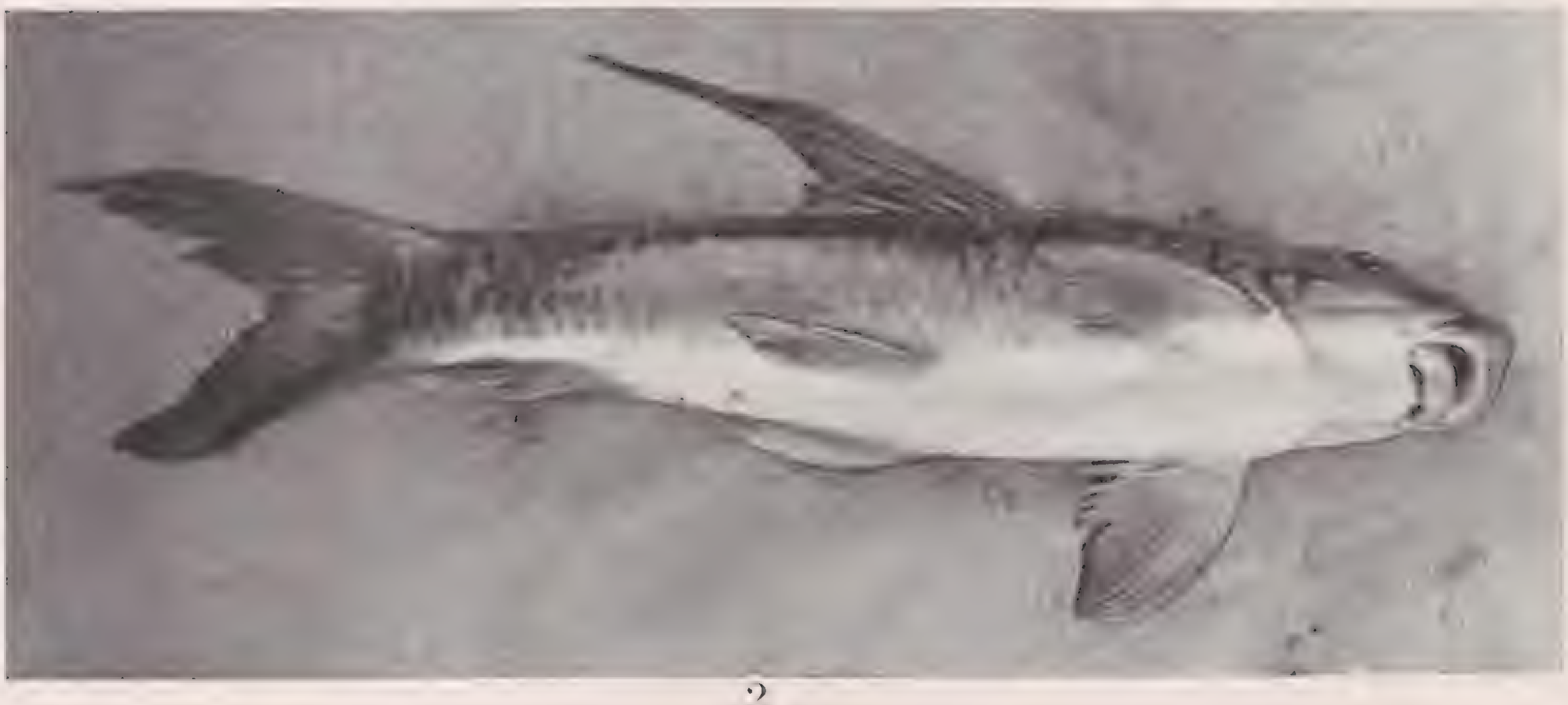
Labeo longipinnis Boul. Rungu. Total length, 695 mm.



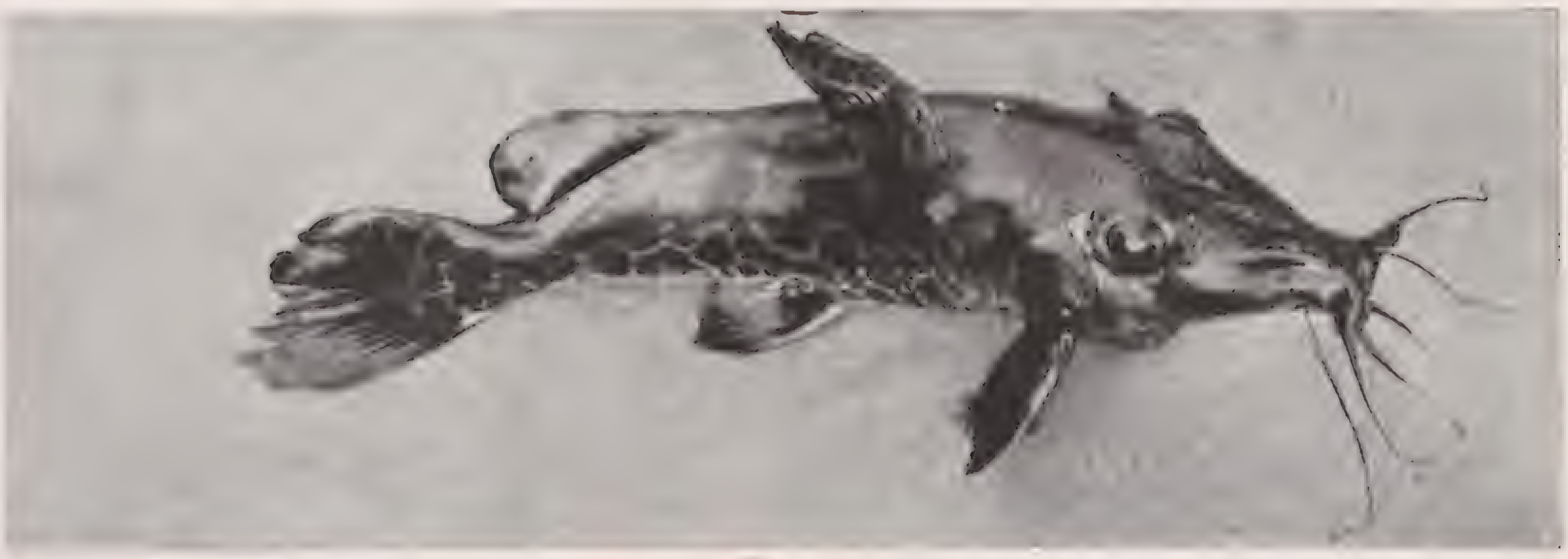
LABEO MACROSTOMA Boul. Rungu. Total length 837 mm. Same specimen as Plate LXXI, Fig. 3.



1



2

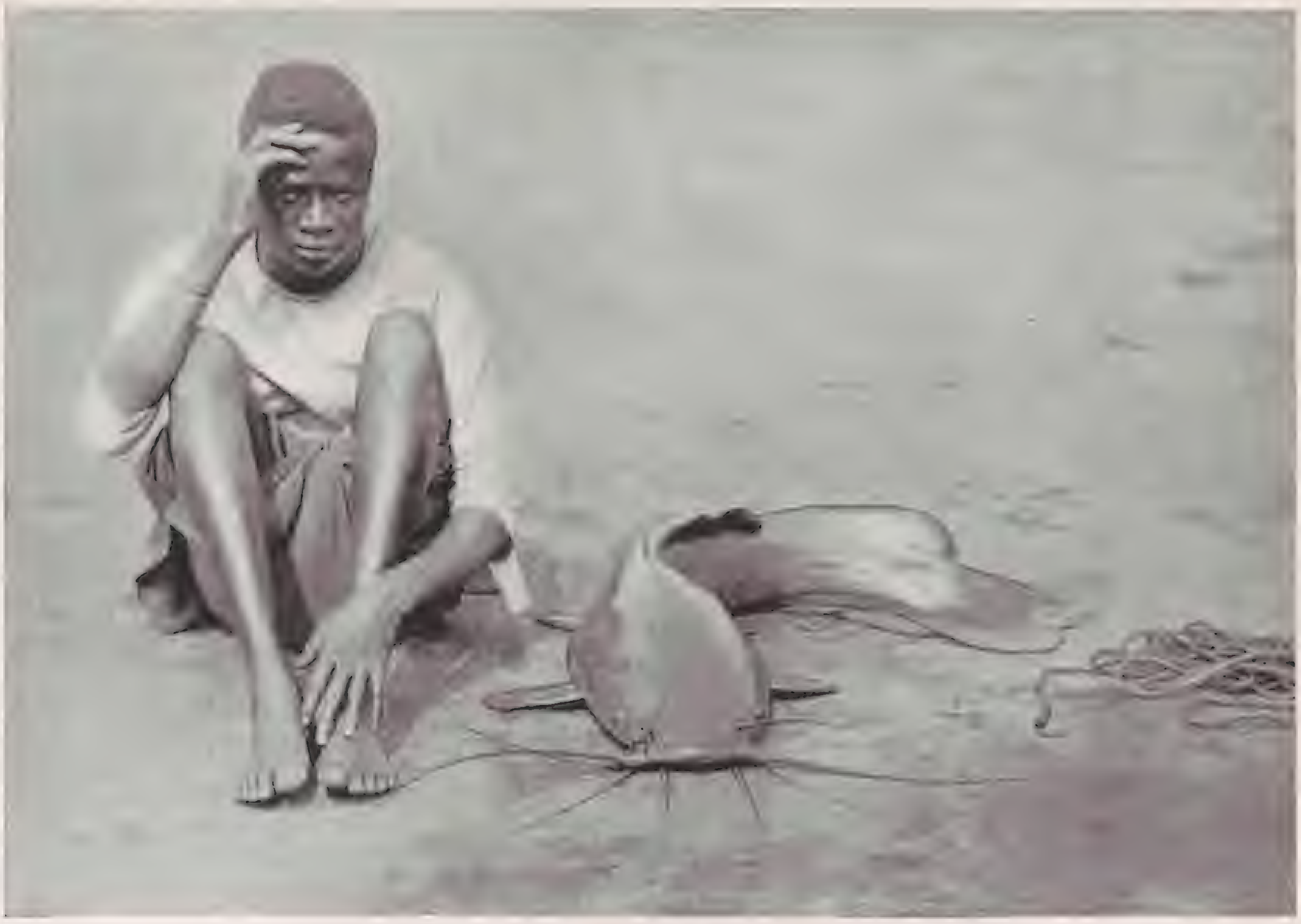


3

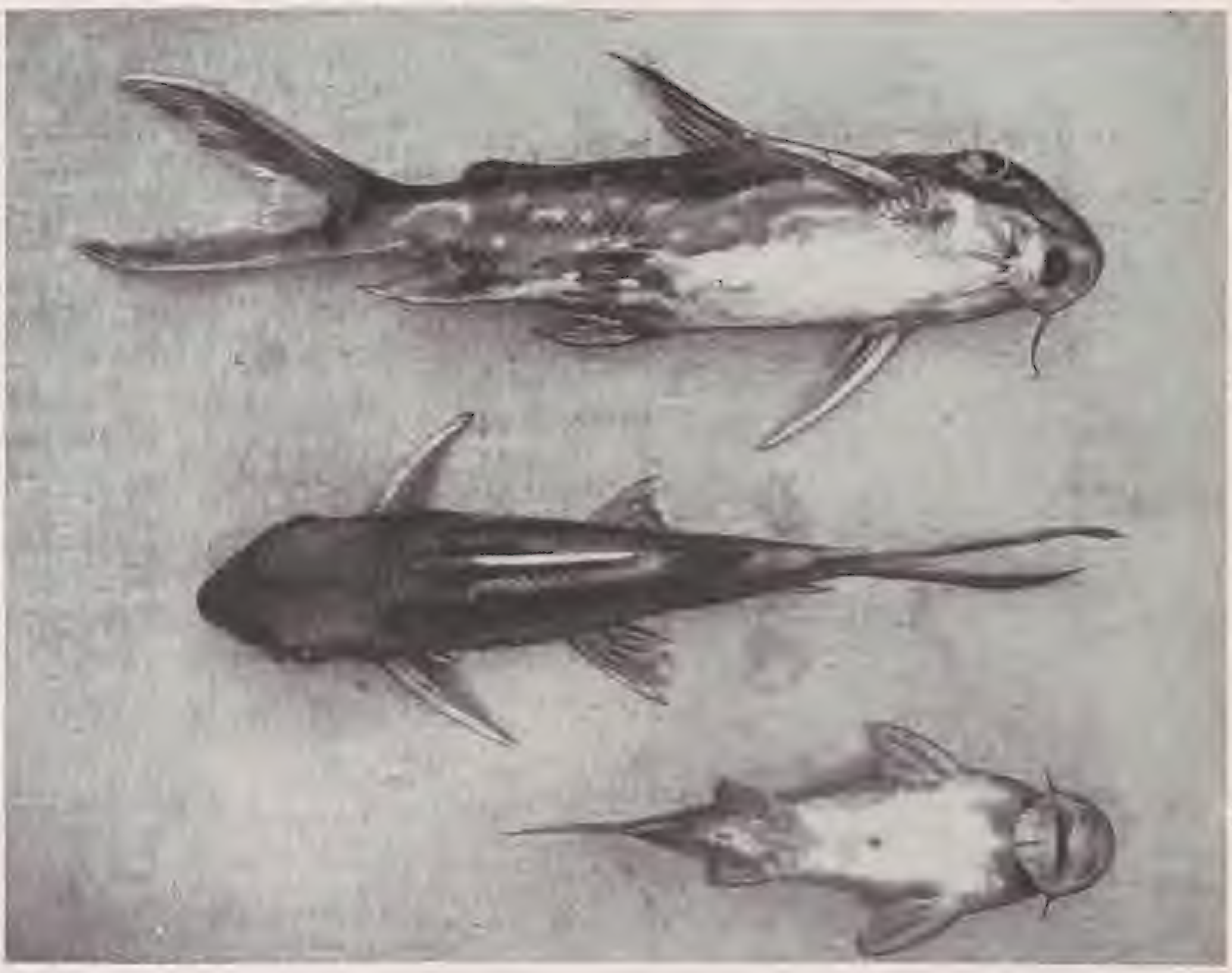
Fig. 1. Labeo greenii Boul. Faradje. Two specimens. Upper 380 mm. Lower 390 mm.

Fig. 2. Labeo chariensis Pell. Faradje. Total length 300 mm.

Fig. 3. Auchenoglanis occidentalis (C. & V.). Faradje. Total length 230 mm.



1



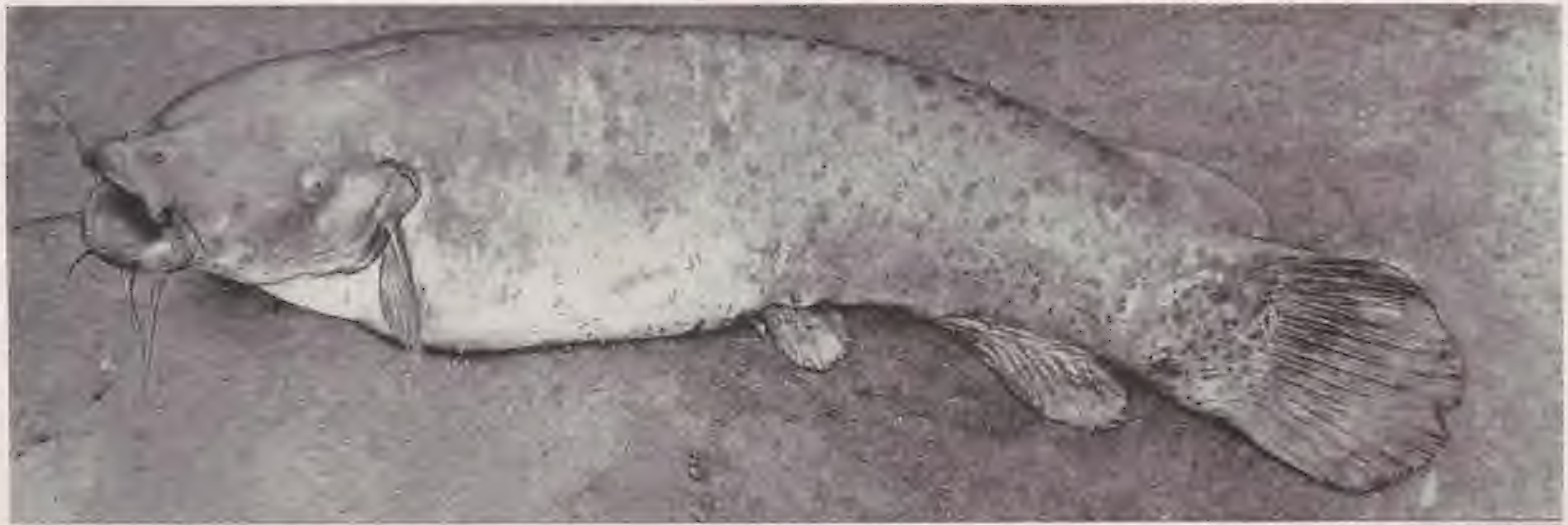
2

3

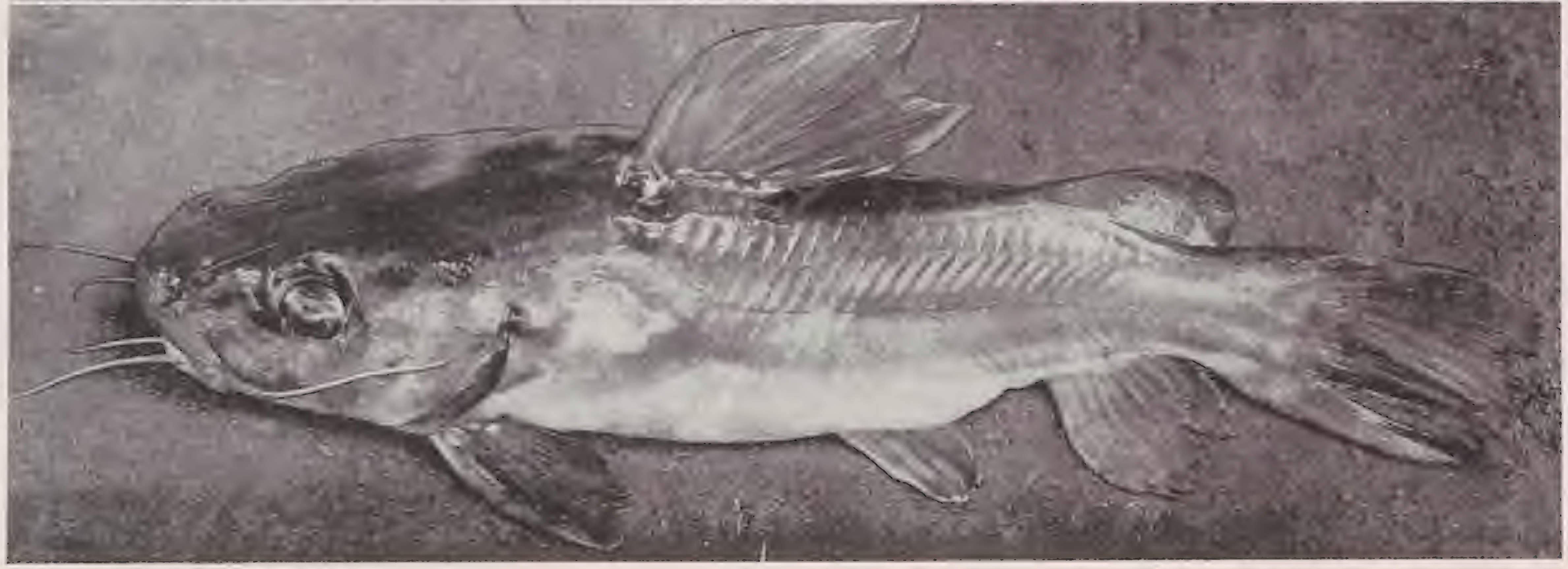
Fig. 1. HETEROBRANCHUS LONGIFILIS C. & V. Faradje. Total length 980 mm.

Fig. 2. SYNODONTIS PLEUROPS Boul. Faradje. Ventral and dorsal views. Total length of larger specimen 210 mm.

Fig. 3. EUCHILICHTHYS DYBOWSKII (Vaill.). Faradje. Ventral view. Total length 115 mm.

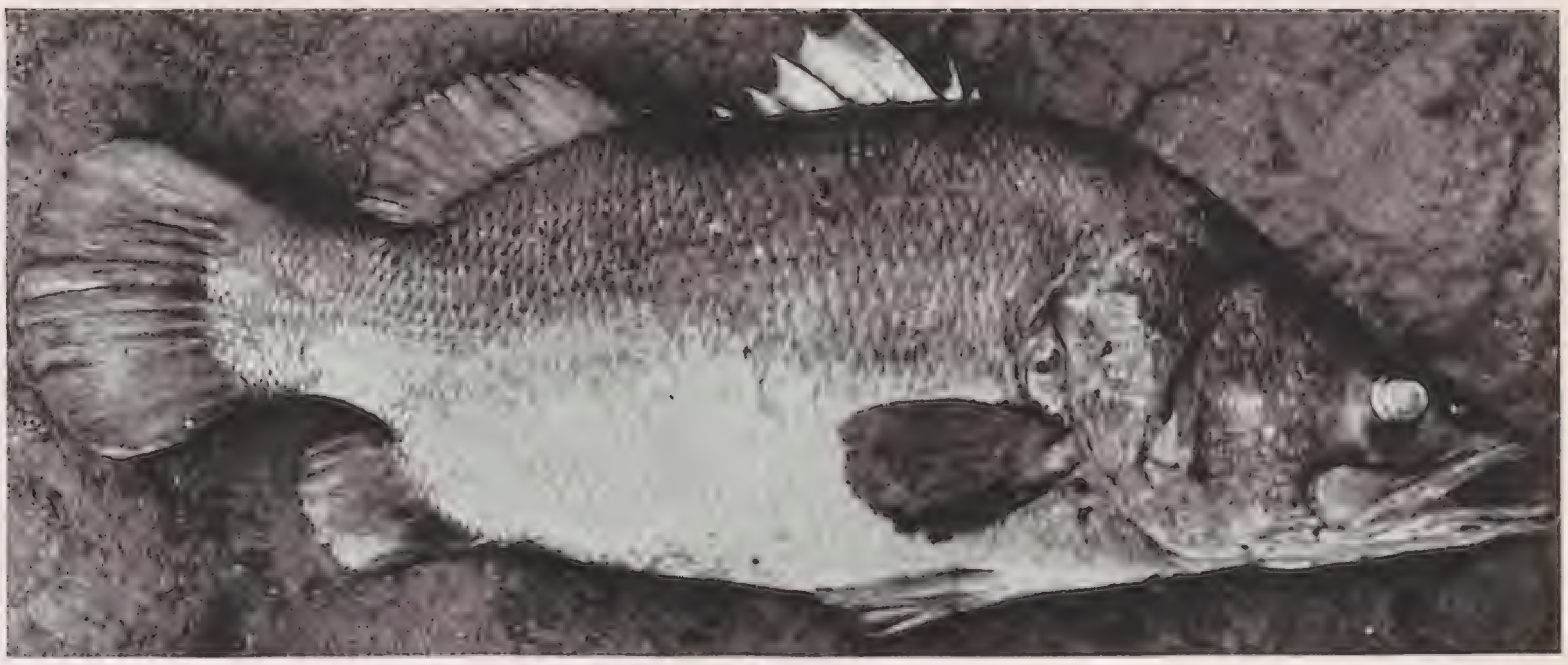


1

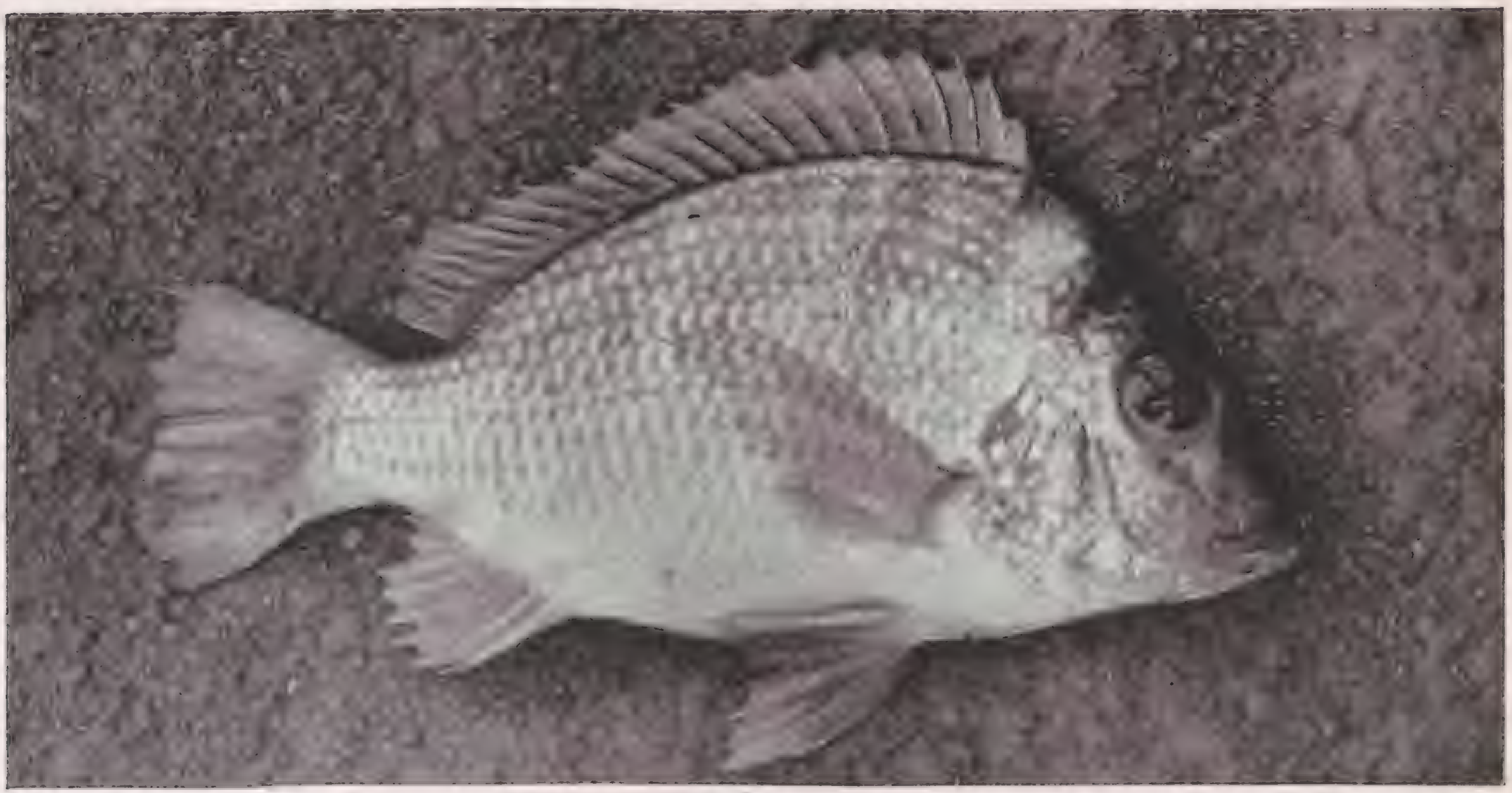


2

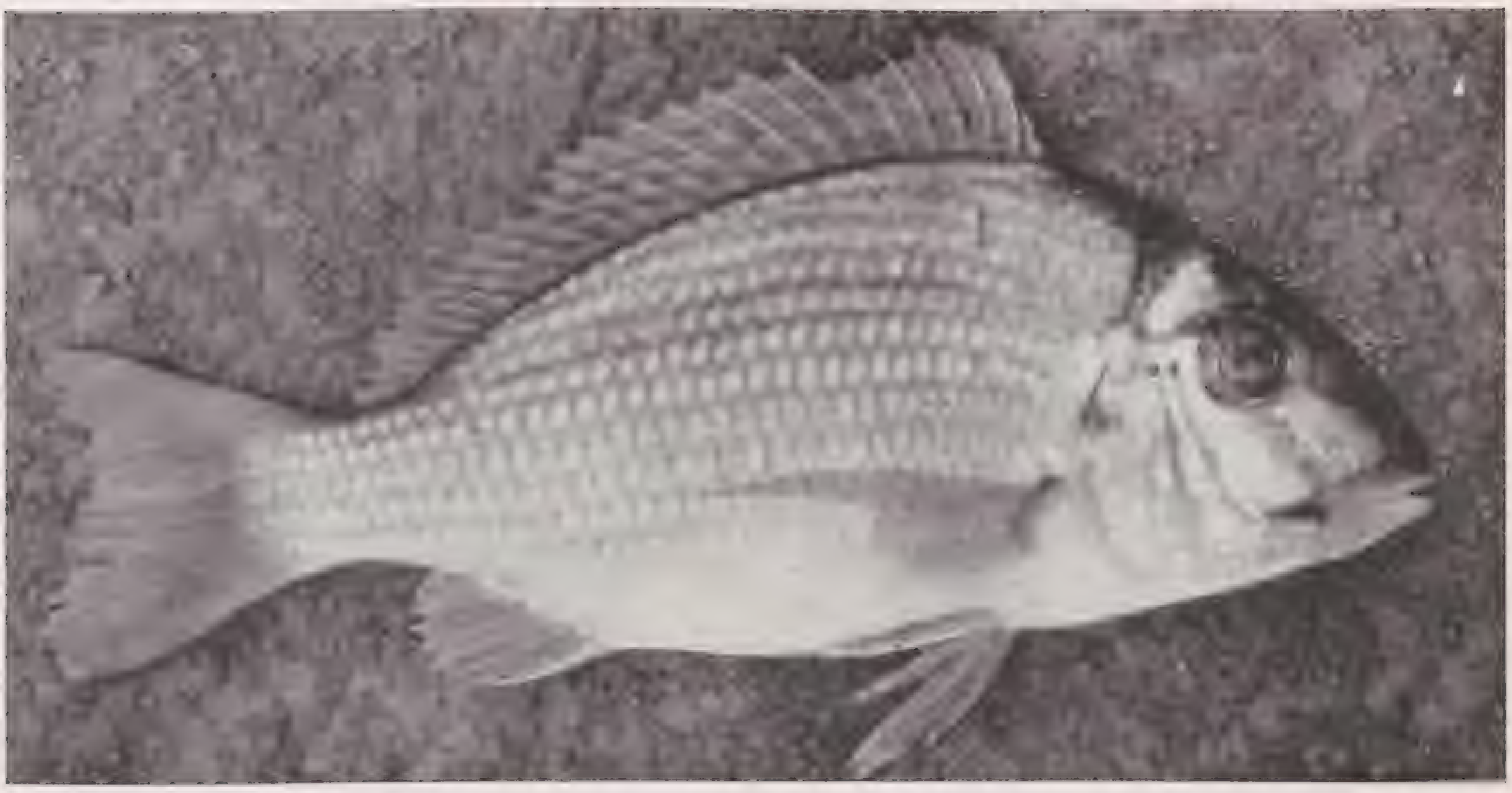
Fig. 1. Malopterurus electricus (Gmel.). Faradje. Total length 720 mm.
Fig. 2. Chrysichthys wagenaari Boul. Poko. Total length 290 mm.



1



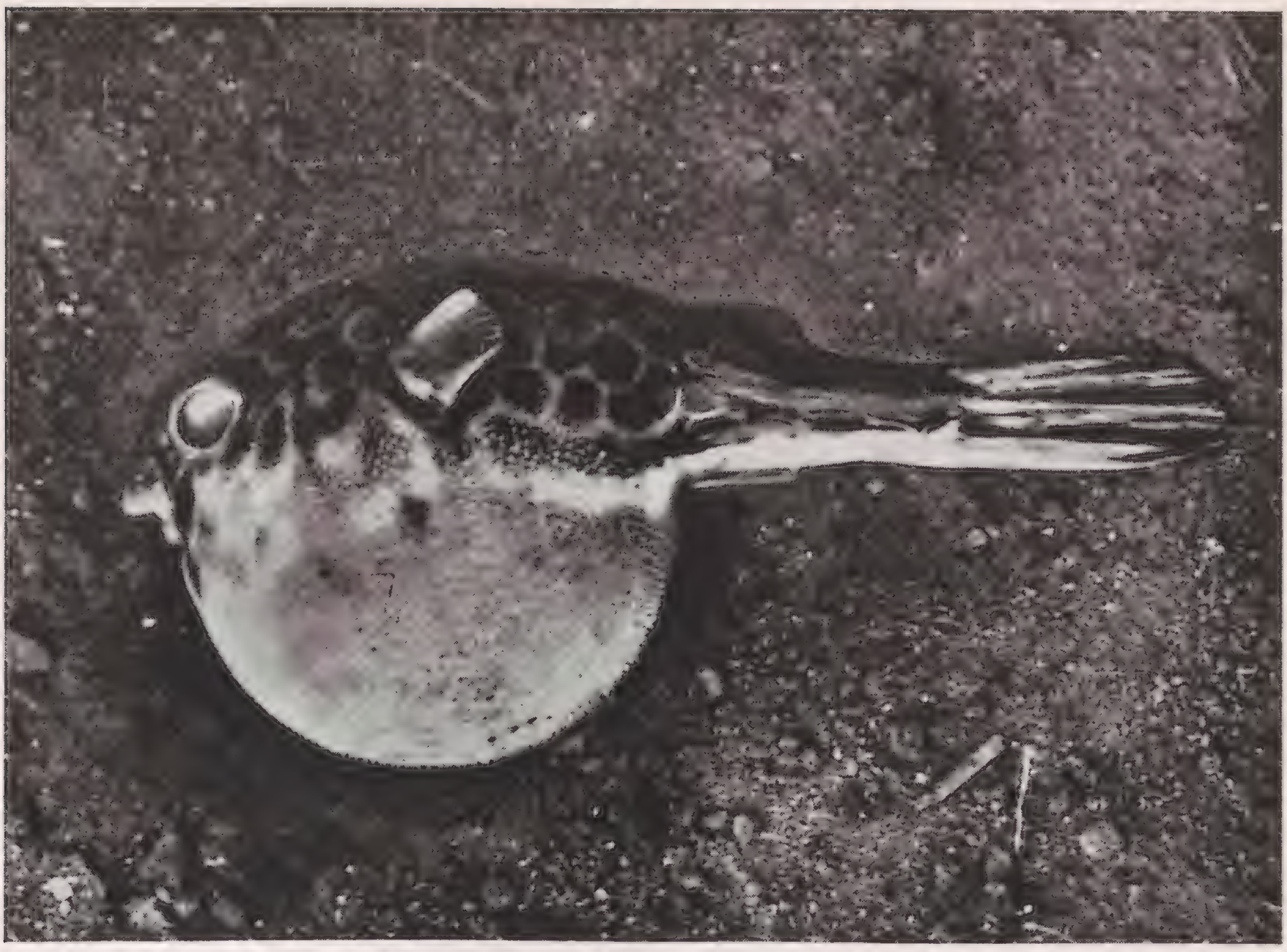
2



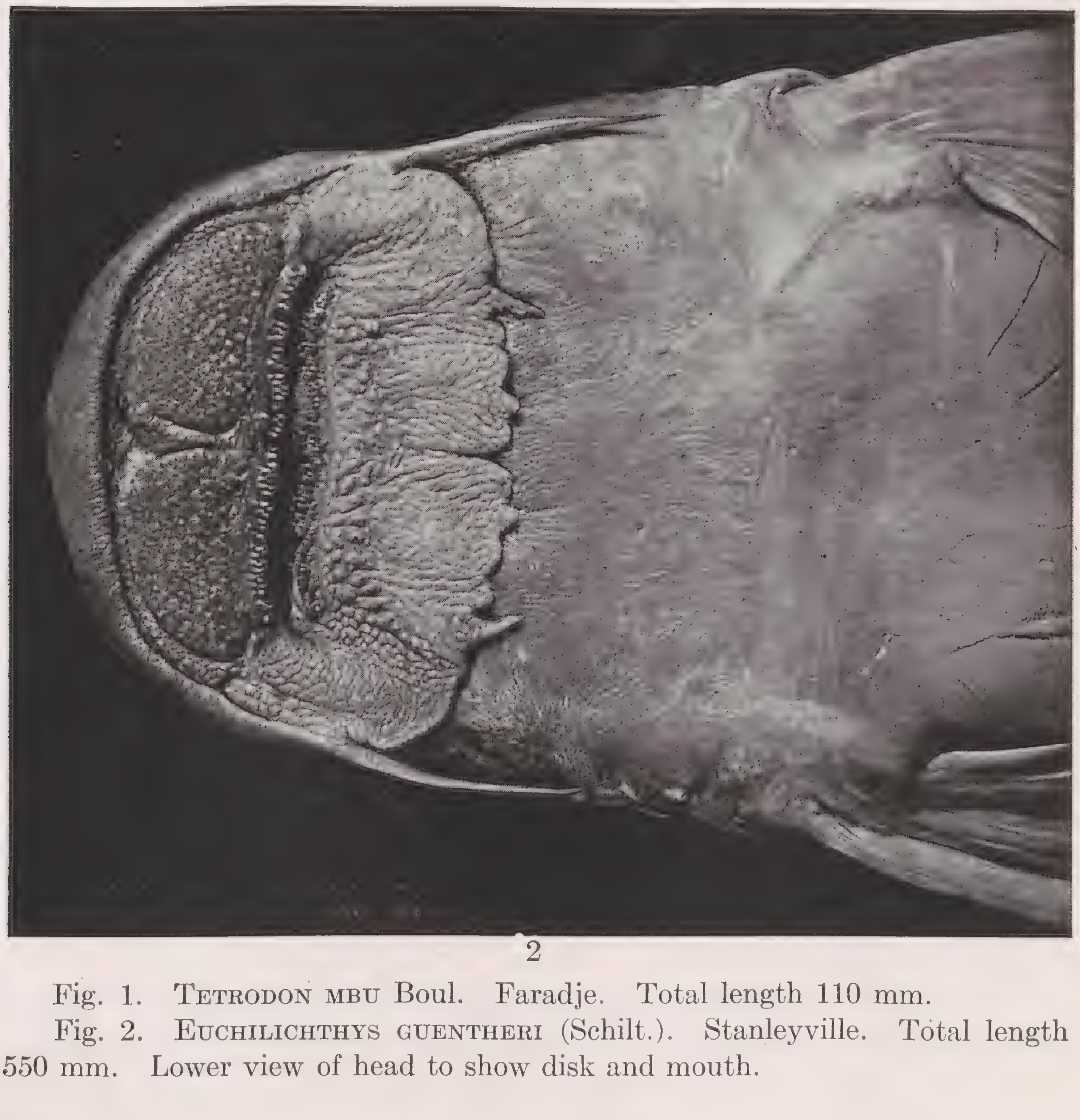
3

Fig. 1. LATES NILOTICUS (Linn.). Faradje. Total length 860 mm.

Figs. 2 & 3. PELMATOCHROMIS LATERALIS Boul. Rungu. To show variation in depth in specimens of the same size. The figures are on the same scale. Total length of upper specimen 210 mm., lower specimen 248 mm.



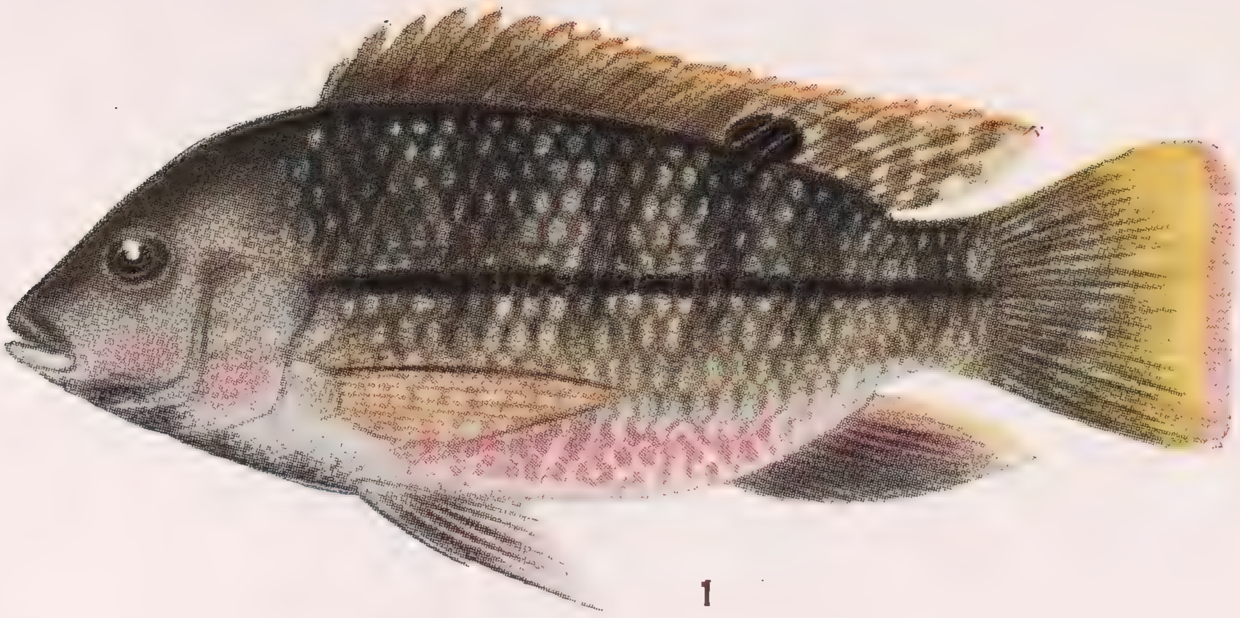
1

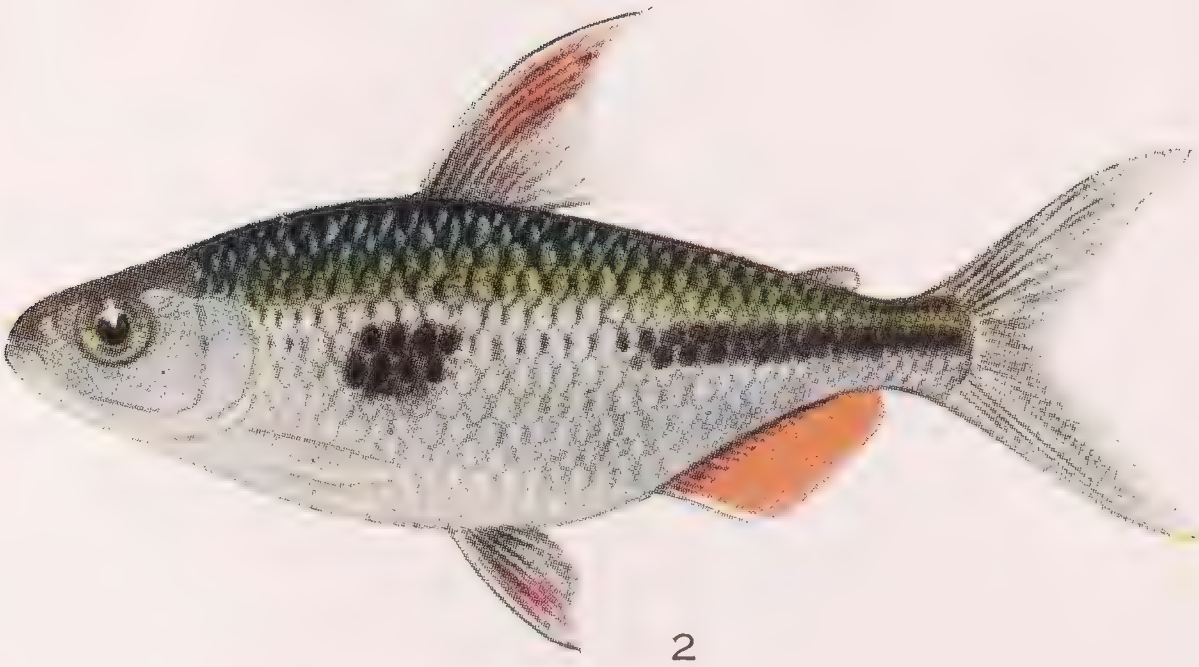


2

Fig. 1. TETRODON MBU Boul. Faradje. Total length 110 mm.

Fig. 2. EUCHILICHTHYS GUENTHERI (Schilt.). Stanleyville. Total length 550 mm. Lower view of head to show disk and mouth.


1


2

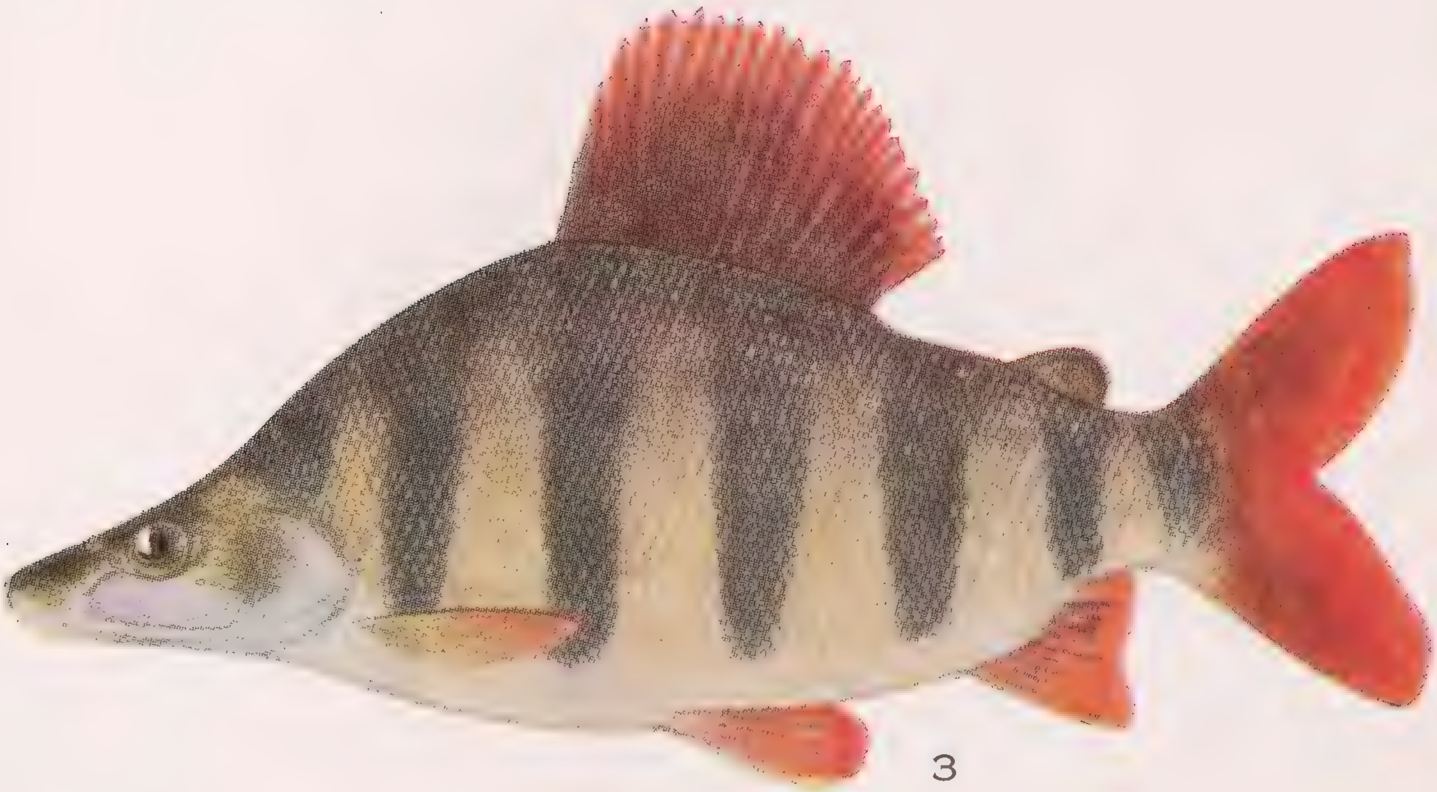
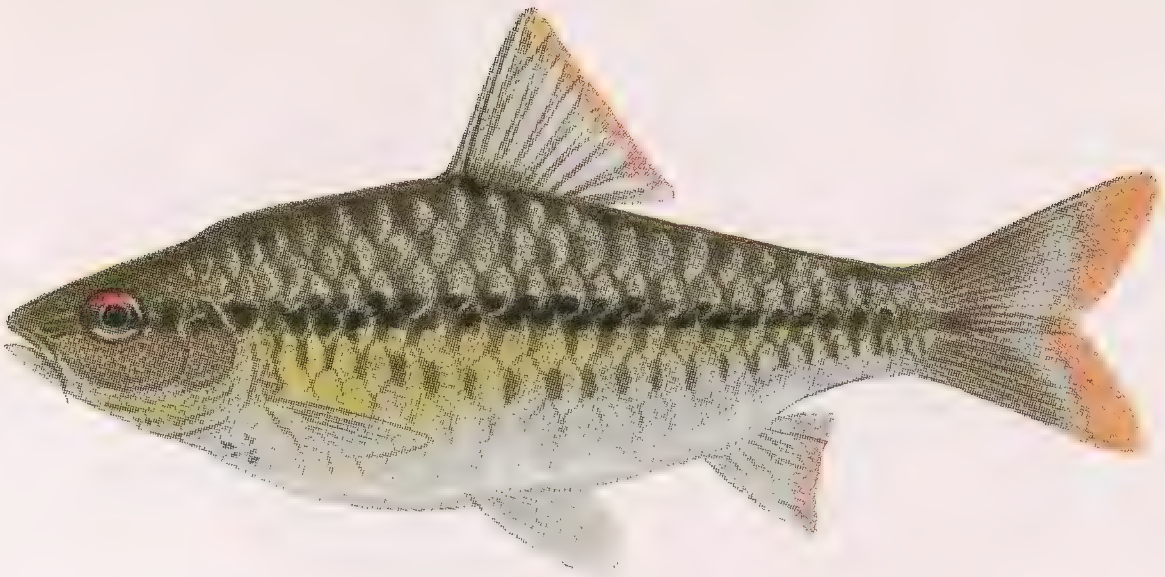
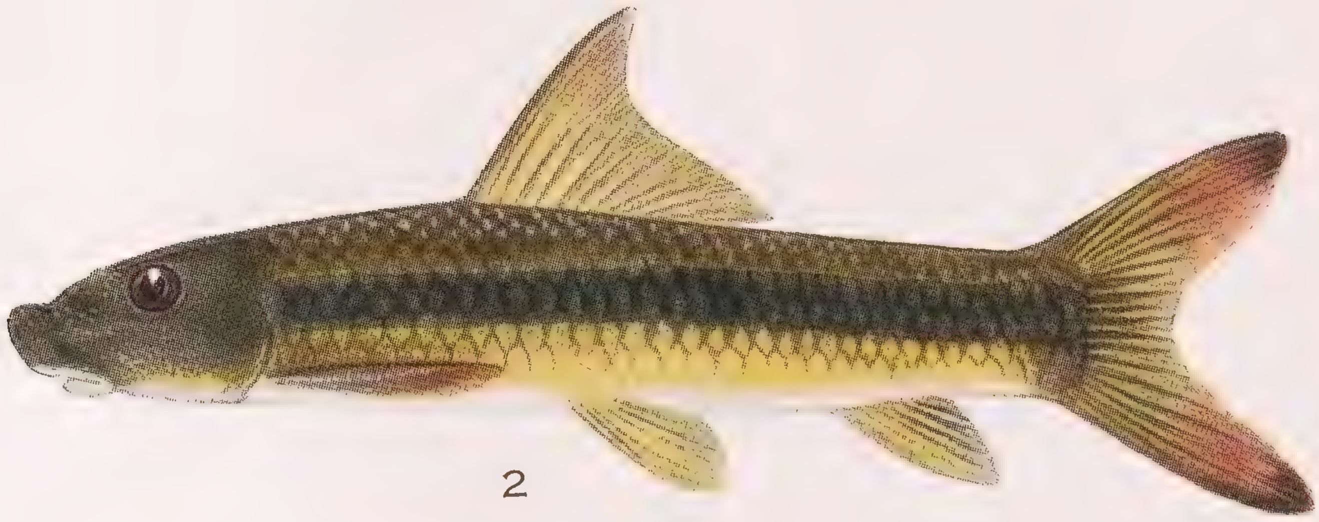

3

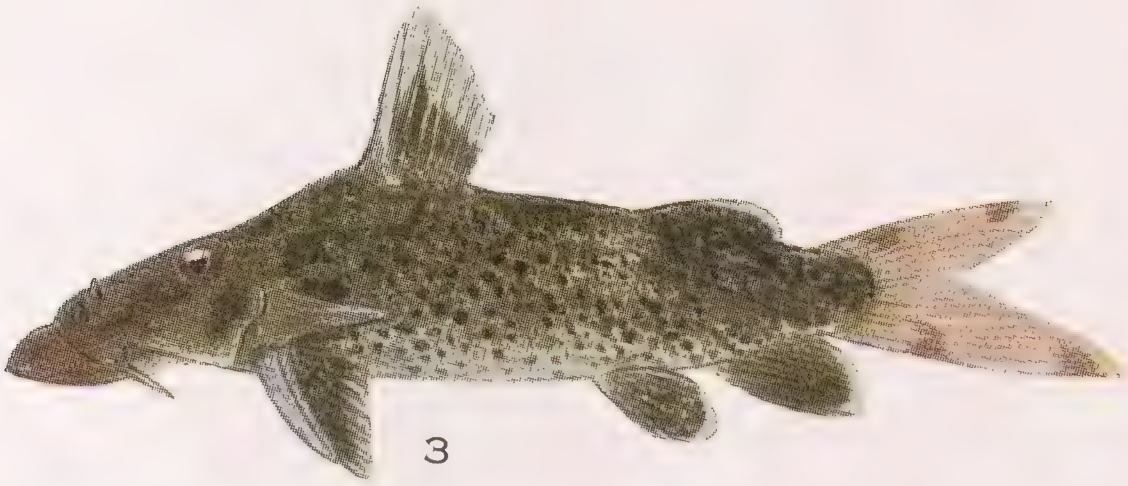
Fig. 1. Tilapia melanopleura *Duméril.*
Fig. 2. Bryconæthiops microstoma *var.* boulengeri *Pellegr.*
Fig. 3. Distichodus lusosso *Schilthuis.*



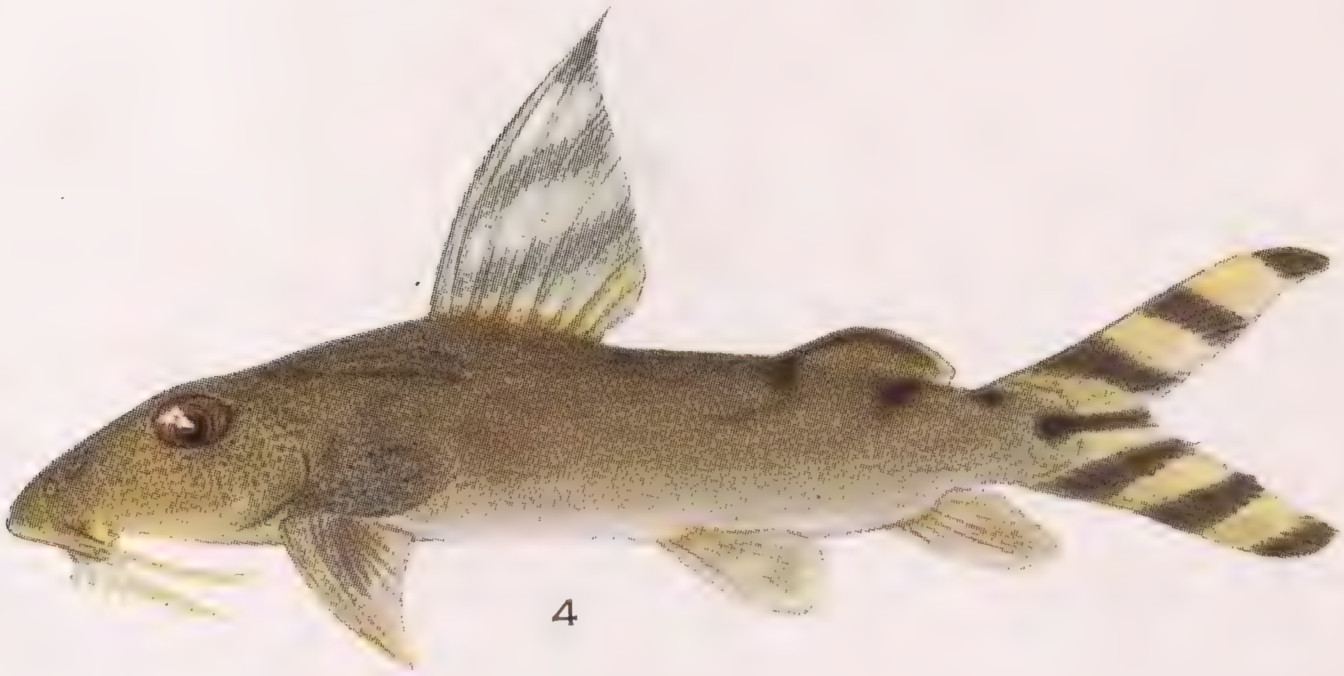
1



2



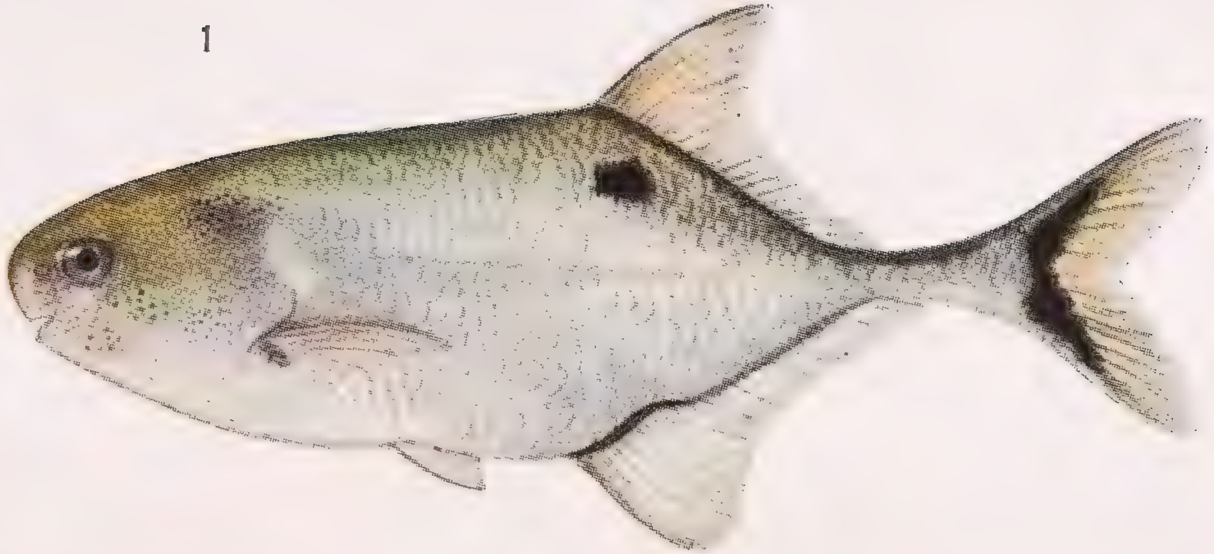
3



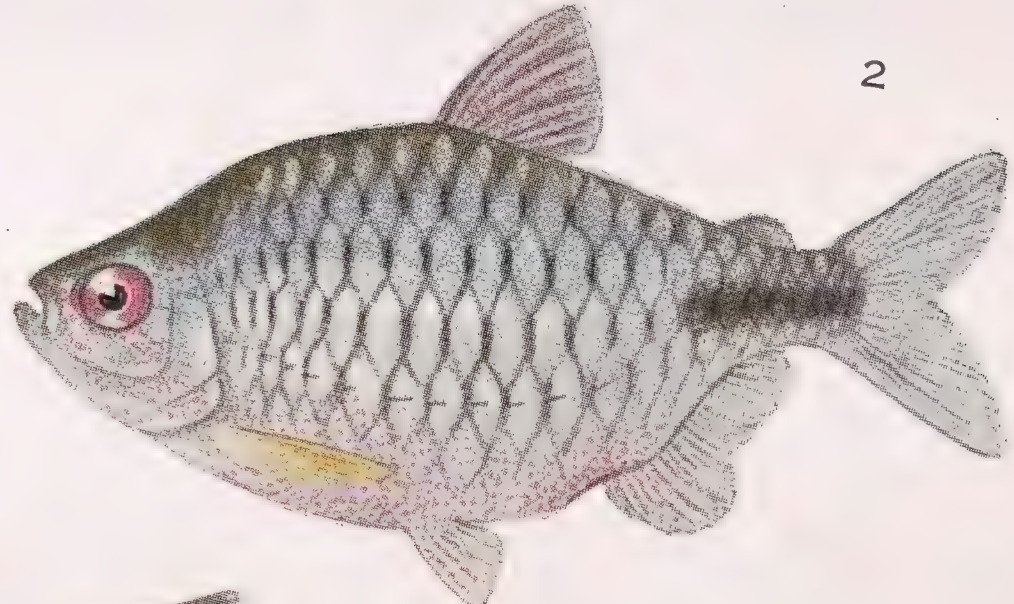
4

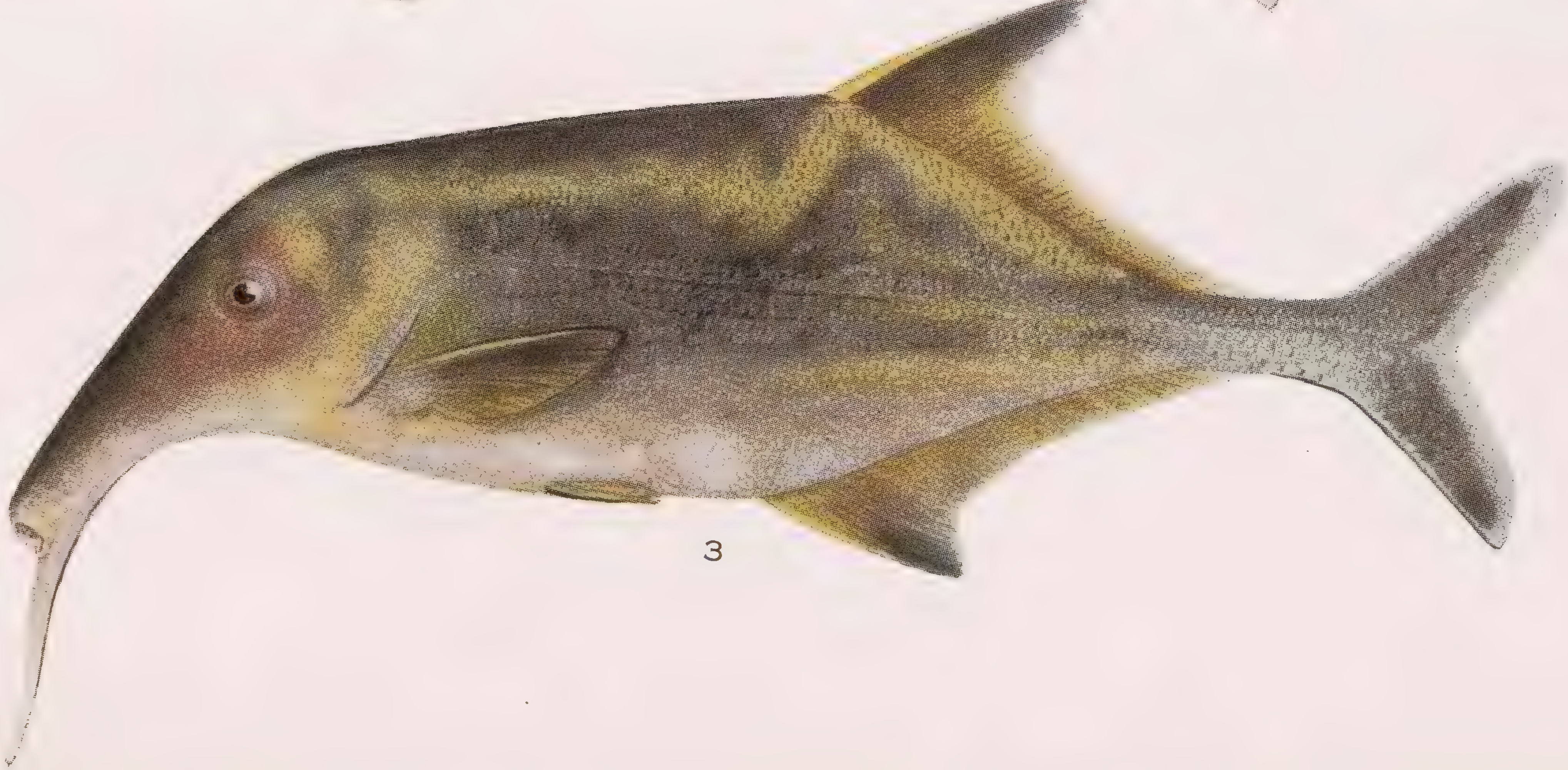
Fig. 1. Barbus holotænia *Blgr.*
Fig. 2. Labeo parvus *Blgr.*
Fig. 3. Euchilichthys dybowskii (*Vaillant*)
Fig. 4. Synodontis decorus *Blgr.*

1



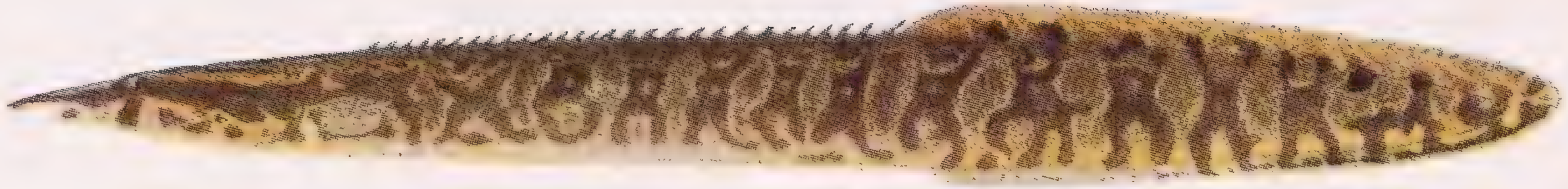
2



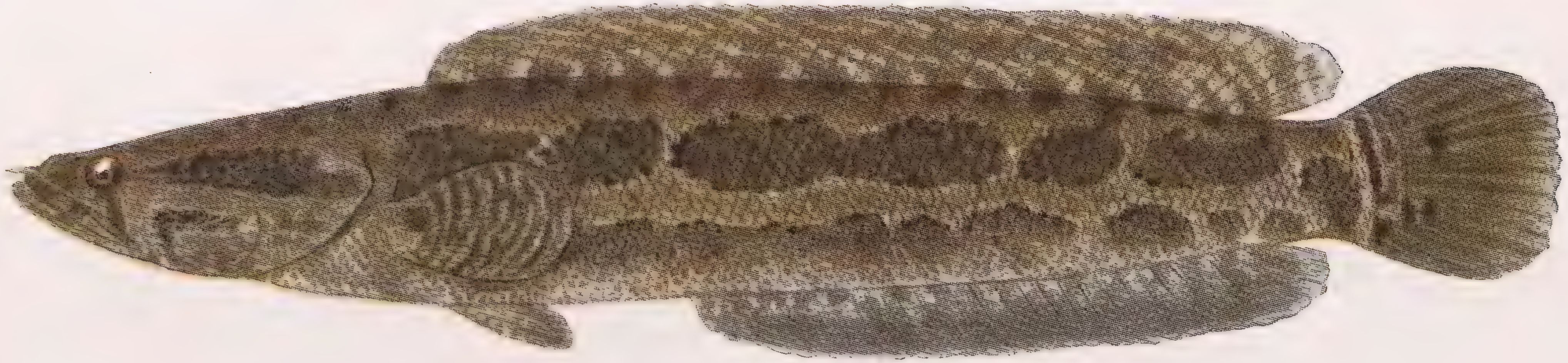


3

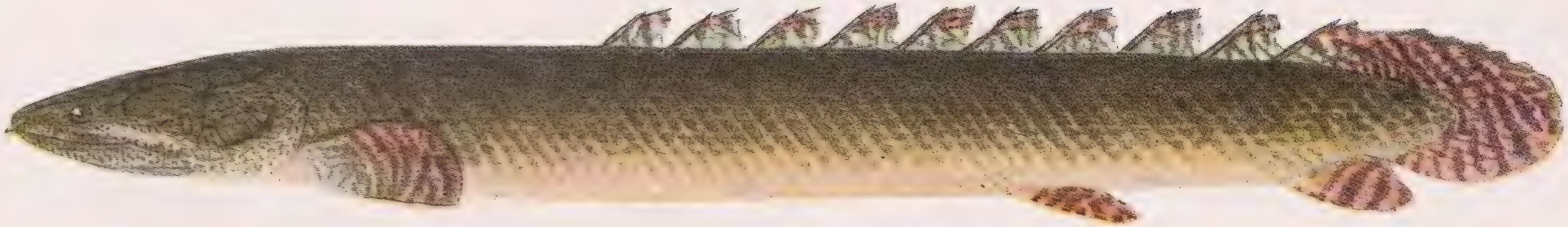
Fig. 1. Petrocephalus ballayi *Sauvage*. Fig. 2. Micralestes altus *Blgr*.
Fig. 3. Gnathonemus mirus *Blgr*.



1



2



3

Fig. 1. Mastacembelus congicus *Blgr.*
Fig. 2. Ophiocephalus obscurus *Günther.*
Fig. 3. Polypterus ornatipinnis *Blgr.*

59.7.55H: 14.31.4

Article XXVI.— DENTITION OF *HYDROCYON* AND ITS SUPPOSED FOSSIL ALLIES.[1]

By Charles R. Eastman.

Plates LXXXIV–LXXXVII.

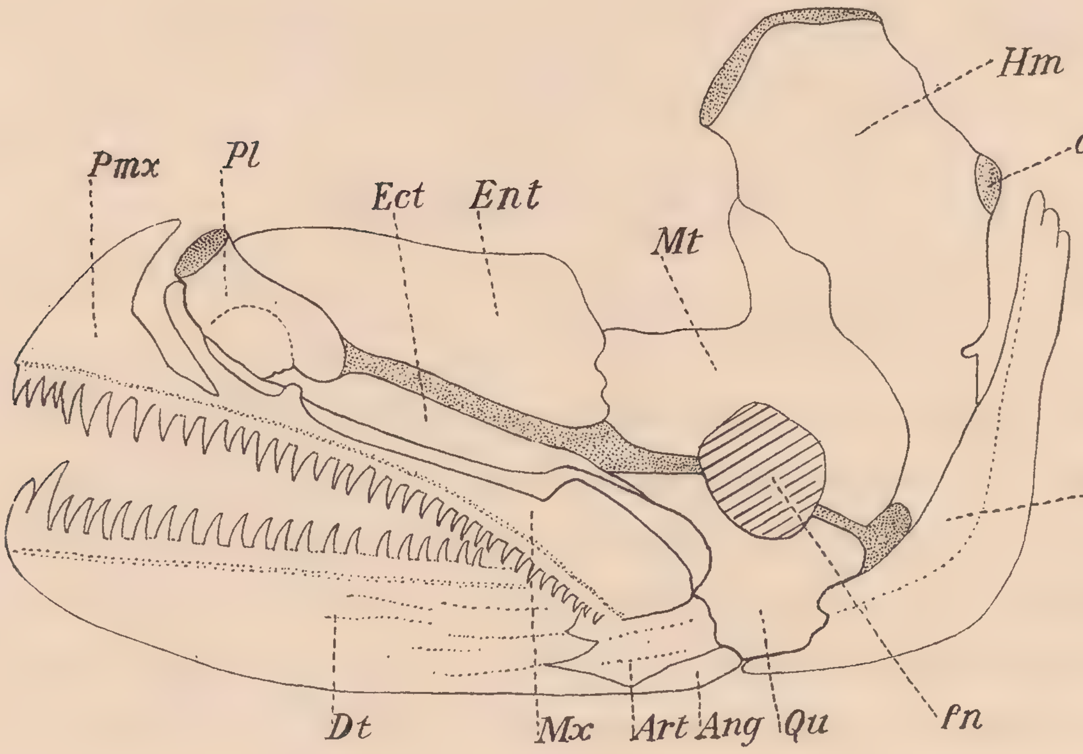
Among the interesting specimens of African fishes brought back by Mr. Herbert Lang, leader of the Belgian Congo Expedition, is one of an adult *Hydrocyon lineatus,* the skull and skeleton of which have been prepared for study. An examination of the dentition shows that this form presents novel features, not heretofore observed among teleosts.

The powerful cutting teeth are not implanted in sockets, nor coössified with the bony elements of upper and lower jaws, but are attached to these elements by ligamentous union, closely paralleling the mode of attachment of teeth to the supporting cartilage in the jaws of sharks. Associated with this peculiar modification is another and still more noteworthy parallelism with dental conditions found in elasmobranchs, namely, as regards replacement of teeth. As functional teeth become effete with use and fall out, or are crowded over on the exterior margin of the jaws, above and below, they are replaced by a series of successional teeth which are formed in separate pouches on the inner face of the premaxillary and dentary bones, and gradually work their way into position so as to stand upright along the functional margin of the jaw bones. Whereas several rows of successional teeth are developed in cartilaginous fishes, apparently not more than two series are present in *Hydrocyon,* the set which is functional at a given time, and another in process of formation. Appearances indicate that tooth formation here, as in elasmobranchs, is a continuous process.

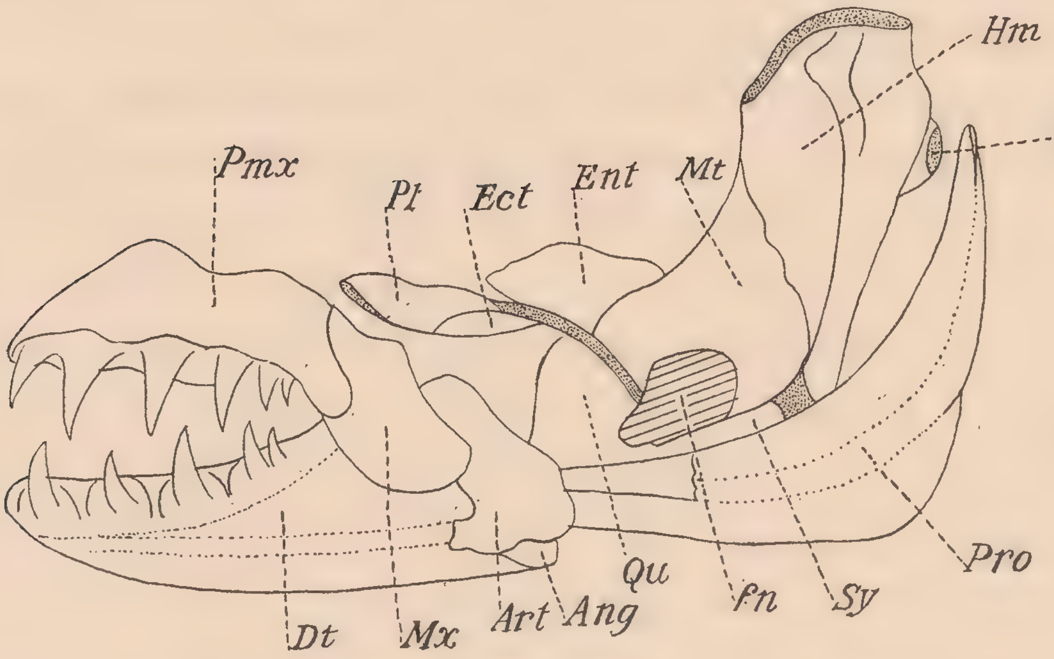
One other remarkable modification remains to be noted. There is no rigid union of the premaxillary and dentary bones at the symphysis, but instead the anterior extremities of both pairs are movably articulated with each other, there being several perfectly formed hinge-like joints in vertical alignment at the symphysis in both jaws, the whole constituting a neat interlocking contrivance for permitting motion and allowing for a lateral expansion of the mouth-angles in the quadrate region. The device is comparable to the hinged dentary bone of mosasaurs, and, so far as known to the writer, does not occur elsewhere than in *Hydrocyon* and one other Characin among fishes. The second known instance where this hinge-like arrangement is developed, is in the South American genus *Hoplias,* as pointed out to the writer by his friend Mr. J. T. Nichols. A lower jaw of *Hoplias* from Colombia, in

---

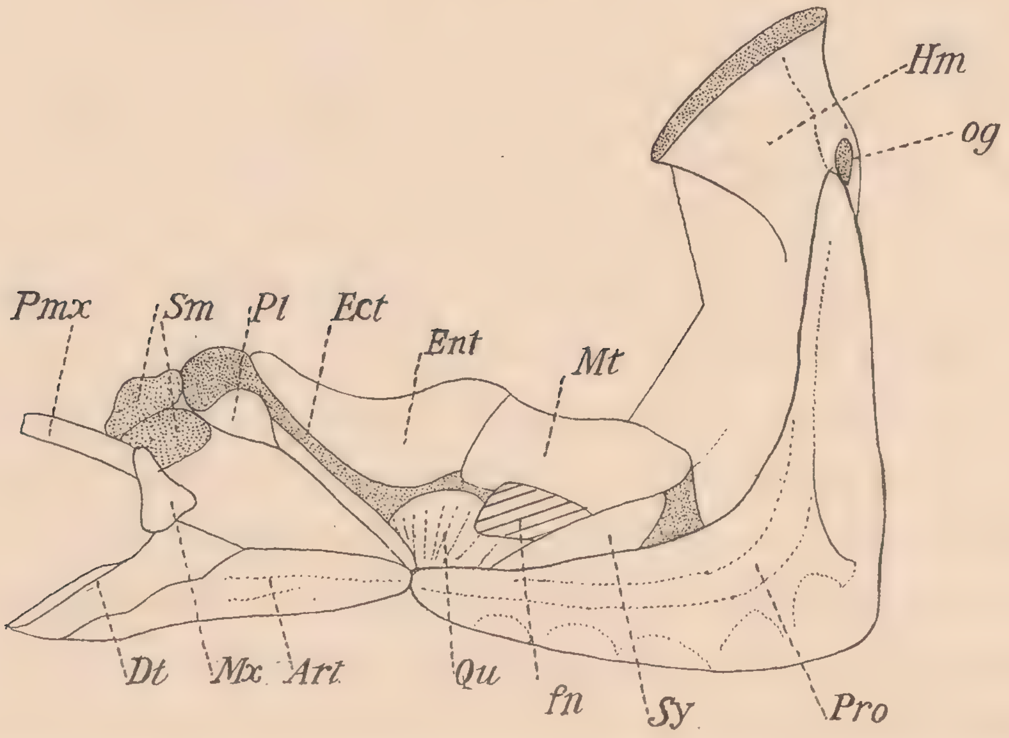
[1] Scientific Results of the American Museum of Natural History Congo Expedition. Ichthyology, No. 2.



1



2



3

Fig. 1. Suspensorial and mandibular apparatus of *Erythrinus*. $1\frac{1}{2}$. *Ang.*, angular; *Art.*, articular; *Dt.*, dentary; *Ect.*, ectopterygoid; *Ent.*, entopterygoid; *fn.*, vacuity between the metapterygoid, symplectic and quadrate; *Hm.*, hyomandibular; *Mt.*, metapterygoid; *Mx.*, maxilla; *og.*, articular surface for the operculum; *Pl.*, palatine; *Pmx.*, premaxilla; *Pro.*, præoperculum; *Qu.*, quadrate.

Fig. 2. Suspensorial and mandibular apparatus of *Hydrocyon forskalii*. $\frac{1}{1}$. Notations same as for Fig. 1. *Sy.*, symplectic.

Fig. 3. Suspensorial and mandibular apparatus of *Citharinus*. $\frac{3}{1}$. Notations same as for Fig. 1. *Sm.*, submaxillary cartilage.

which this character is distinctly shown, has recently been presented to the American Museum by Mr. Leo E. Miller, who collected it.

The articulations observed in a few specimens of *Coccosteus* along the front margin of the jaws appear to have been in the nature of teeth, and to have subserved a different function than that here noted for *Hydrocyon* and *Hoplias.*

An excellent description of the structure of the skull in Characins is given by M. Sagemehl in the 'Morphologisches Jahrbuch' for 1885 (Vol. 10, pp. 1–119). The article is accompanied by illustrations, reproduced in Text Figs. 1–3, which show the formation of the mouth-parts in two genera of carnivorous and one of herbivorous Characins. The latter type, such as is presented by *Citharinus* (Text Fig. 3) recalls conditions found in *Amia,* and is regarded as "weit primitiver" than the type of jaw-structure found in *Hydrocyon* and *Erythrinus.* Nothing is said by the author regarding the mode of replacement of the teeth or of the movable articulation at the symphysis in *Hydrocyon.*

Fossil predecessors of Characins have not been hitherto identified with certainty, and accordingly any information regarding the geological history of the group is to be welcomed. Now it is an interesting fact that in searching fossil records for a type of tooth-structure similar to that represented by *Hydrocyon,* a very close approximation is found in the species of detached teeth from late Cretaceous and early Tertiary strata which have been described under the names of *Onchosaurus, Ischyrhiza* and *Gigantichthys.*[1]

All of these forms, like *Hydrocyon,* have elongated, acuminate crowns with slightly compressed, trenchant edges, and covered with a thin layer of enamel. The root is vertical, abruptly truncated below and hollowed interiorly, with coarse crenulations on the outer surface near the base. Examining the root from below, the basal portion is seen to be deeply excavated along the median line by a longitudinal groove. The characters last described evidently provide means for securing a firm attachment of the teeth to the supporting tissue of the jaws, since the teeth are not implanted in alveoli. In all of these respects, there is remarkably close agreement between the above-named fossil teeth and those of the recent genus *Hydrocyon.* The conclusion appears inevitable that all these forms are related, and that the ancestry of modern Characins may be traced back to *Onchosaurus* of the Cretaceous. One of the fossil species, *O. pharao* (Dames) is found in the Upper Cretaceous of Africa, and other representatives occur in Europe and North America. The type of *O. mira* (Leidy), now preserved in the American Museum of Natural History, is shown in Plate LXXXVI, B–C.

---

[1] For a discussion of the synonymy and probable relationships of these forms, see an article by the present writer in the 'American Naturalist' for 1904, Vol. 38, p. 298.

EXPLANATION OF PLATES LXXXIV–LXXXVII.

Plate LXXXIV.

Lower jaw of *Hydrocyon lineatus* to show the peculiar interlocking hinge-joint at the symphysis.

A. View from above of dentaries spread apart to greatest extent. $\frac{1}{2}$.

B. Same view; dentaries approximated as closely as possible. $\frac{1}{2}$.

C. Posterior view of the hinge when fully opened. $\frac{2}{3}$. Although the dentaries can be freely moved, they cannot be separated without injury as in *Hoplias*. The successional teeth may be seen, lying in the alveolar pits with the points directed backward, so that a rotation is necessary to bring them in functional position. Note the peculiar form of attachment of the teeth suggesting *Onchosaurus mira* (Plate LXXXVI, Figs. *B* and *C*).

Plate LXXXV.

Ventral view of anterior portion of skull of *Hydrocyon lineatus* with the tooth bearing premaxillæ and the hinged symphysis. $\frac{1}{1}$. The mesethmoid is expanded laterally to furnish an articular surface for the necessary movements of the premaxillæ. The successional teeth are clearly shown in their alveolar pits.

Plate LXXXVI.

Two distal teeth (*A*) of right dentary of *Hydrocyon lineatus* compared with front (*B*) and side (*C*) views of tooth (type specimen No. 10452, A. M. N. H.) of *Onchosaurus mira* (Leidy) from the Cretaceous of New Jersey. (Natural size.) Note the remarkable similarity in general form, especially near the base, that suggests the same mode of attachment.

Right lower jaw (*D*) of *Hoplias* (a South American Characin) viewed from inside ($\frac{3}{2}$), and outer view of the largest anterior tooth (*E*). ($\frac{4}{1}$). As in *Hydrocyon* and *Onchosaurus*, all these large teeth are slightly hollow inside and are fastened to the dentary by only ligamentous connection. The gum-covered, basal, ridged portion is completely free from enamel and in this feature and its strongly trenchant edges, *Hoplias* resembles even more the Cretaceous form, whereas in *Hydrocyon* the enamel often reaches nearly to the base of the teeth.

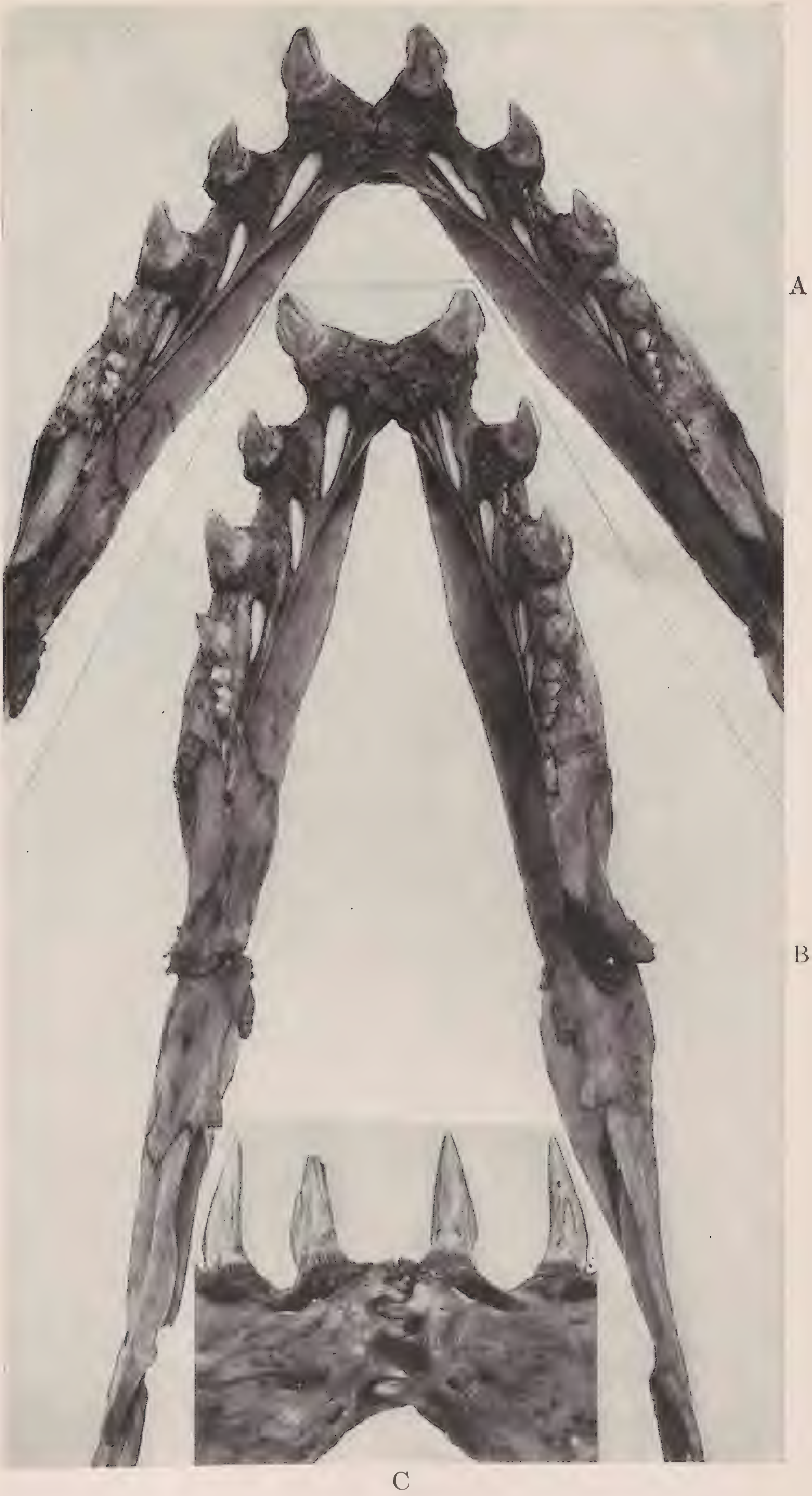
The hollow rear portions of some of the successional teeth are seen in their natural position near the front of the jaw; they become functional without rotation.

One side of the large interlocking hinge at the mandibular symphysis is clearly shown and resembles much in form and in function that of *Hydrocyon*.

Plate LXXXVII.

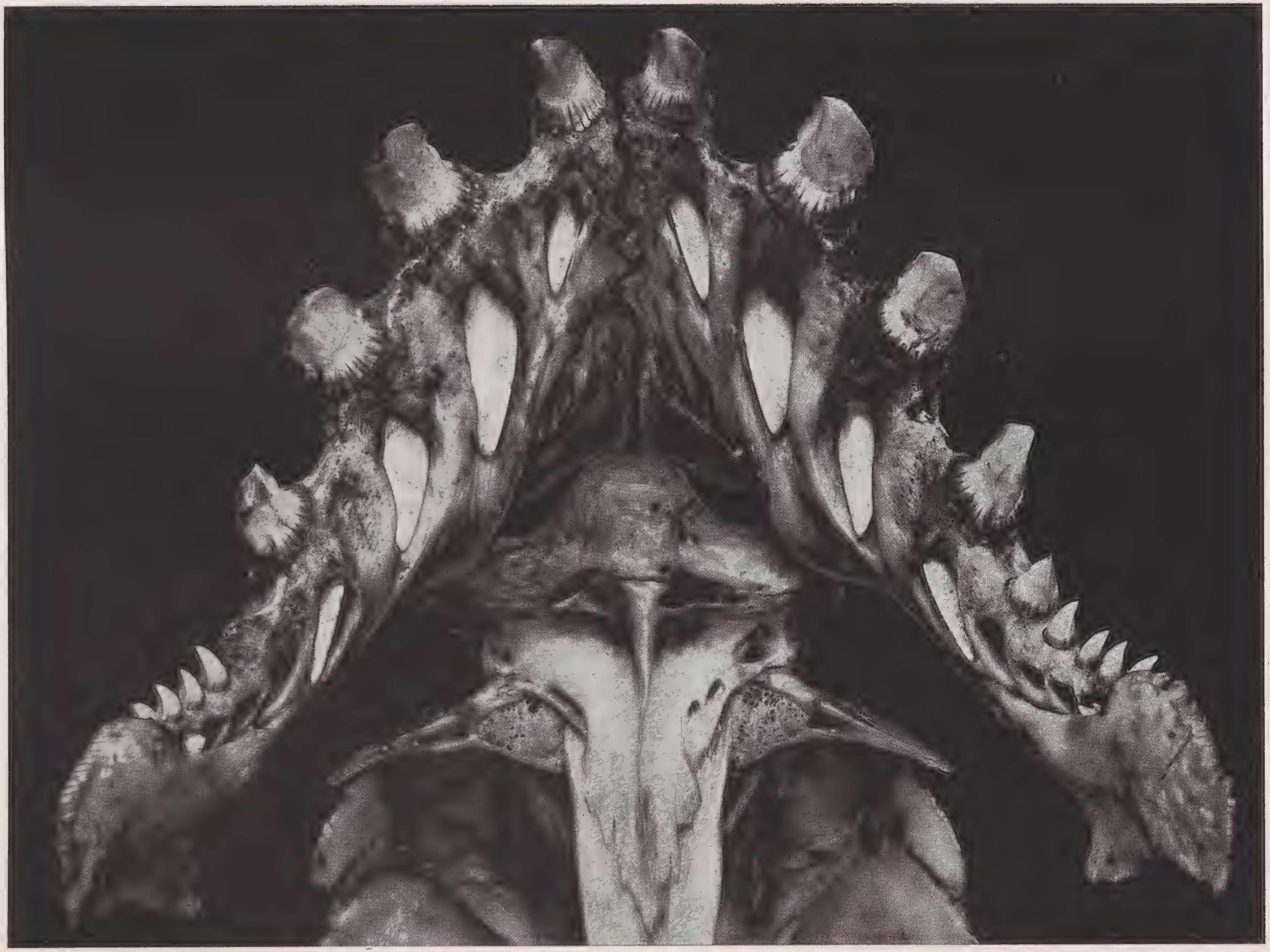
Head of *Hydrocyon lineatus* (*A*) to illustrate the interlocking of the teeth when the mouth is closed. It is interesting to note that about half of the entire length of the teeth is embedded in the gum. The wide-open mouth of this specimen is figured in Plate LXX, Fig. 1. Photo by H. Lang from a freshly captured specimen (total length 61 cm.), Faradje, Uele District, Belgian Congo.

Left premaxilla of *Hydrocyon lineatus* (*B*), viewed from inside ($\frac{3}{1}$), showing the one and only series of reserve teeth. These are obliged to rotate into functional position like those of sharks and are attached to the jaw by simple ligamentous connection, without sockets or coössification.

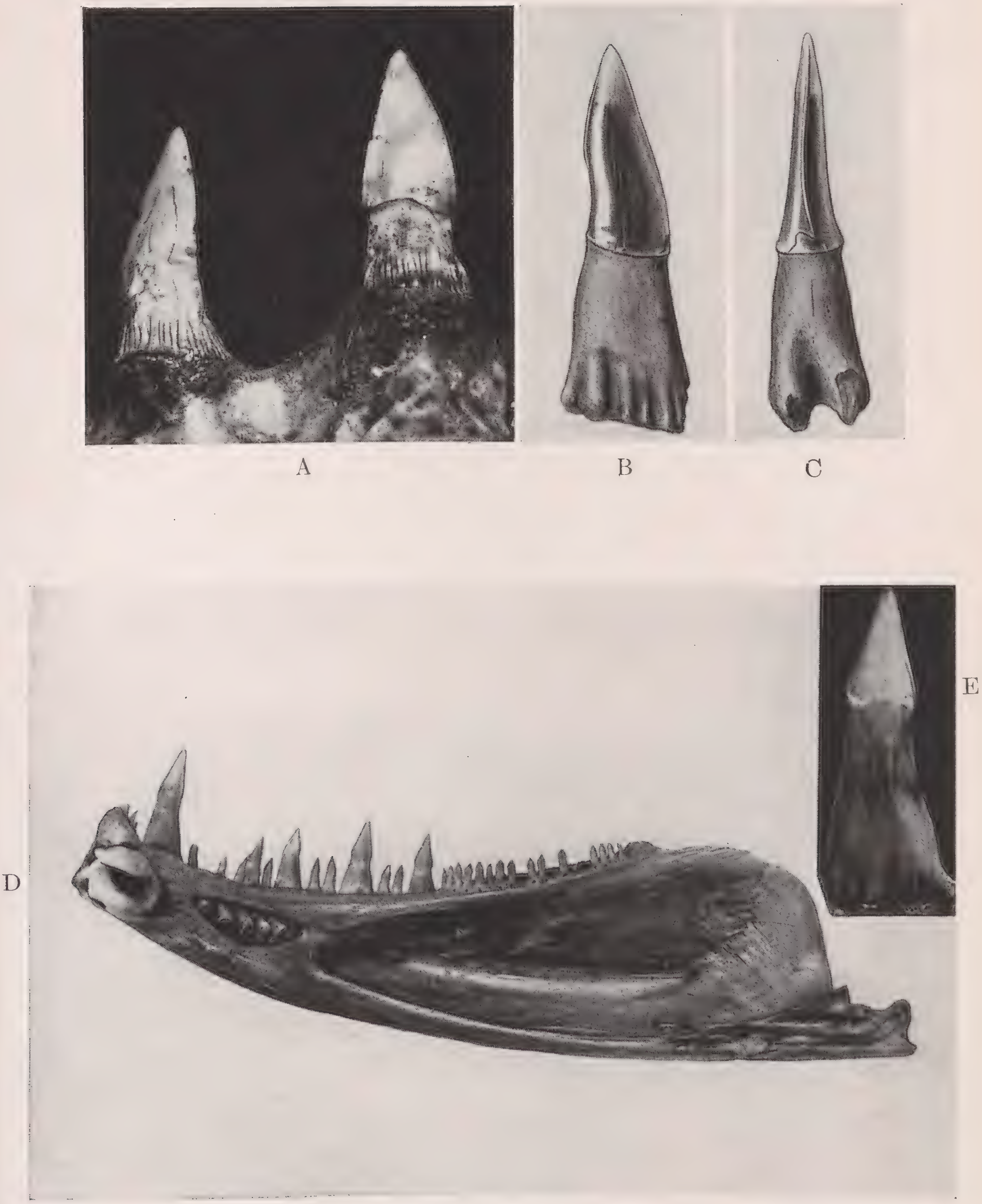


Lower jaw of *Hydrocyon lineatus* to show the peculiar interlocking hinge-joint at the symphysis.

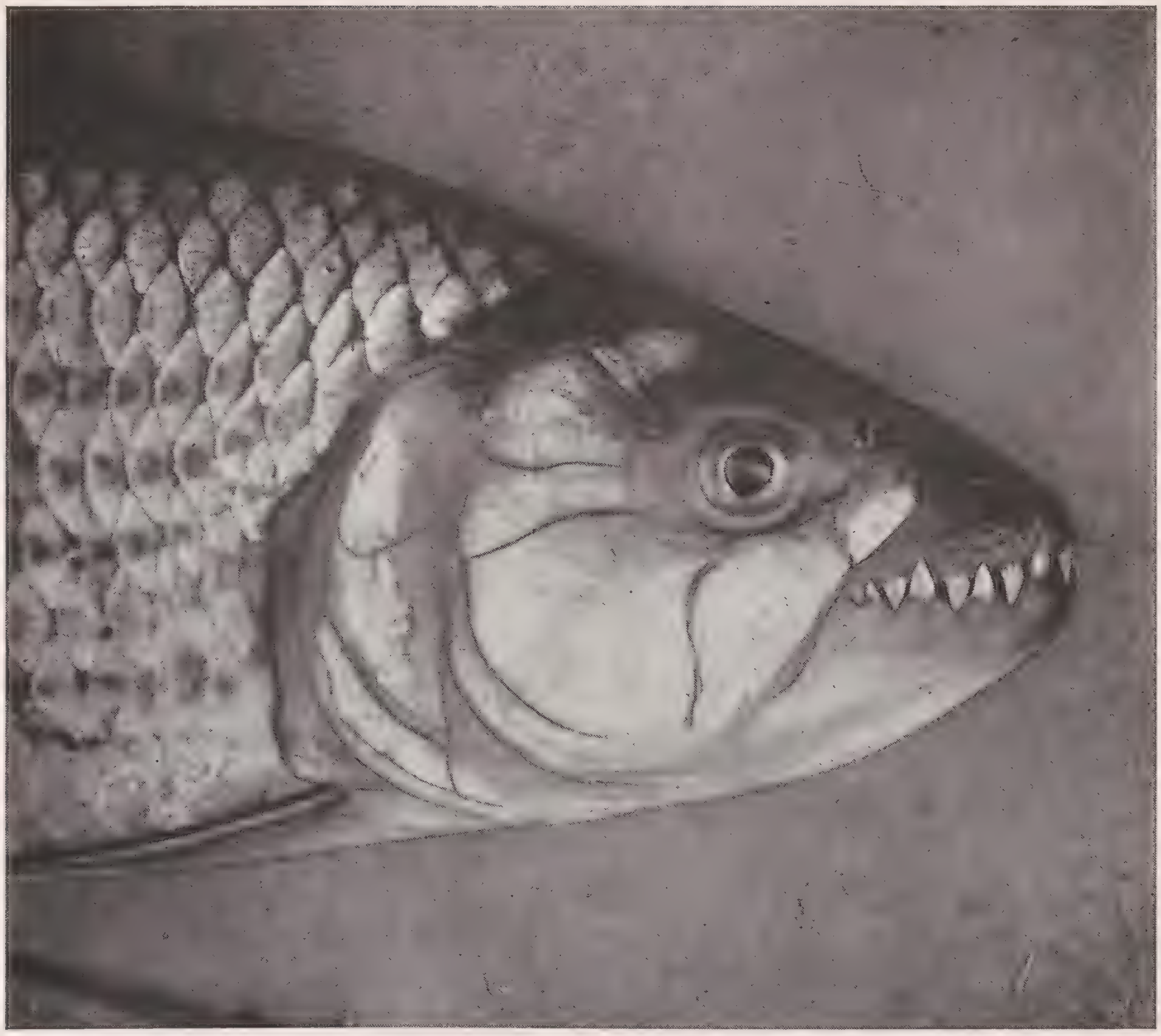
A, dentaries spread apart fully; *B*, closely approximated ($\frac{1}{2}$); *C*, posterior view of the hinge ($\frac{2}{3}$).



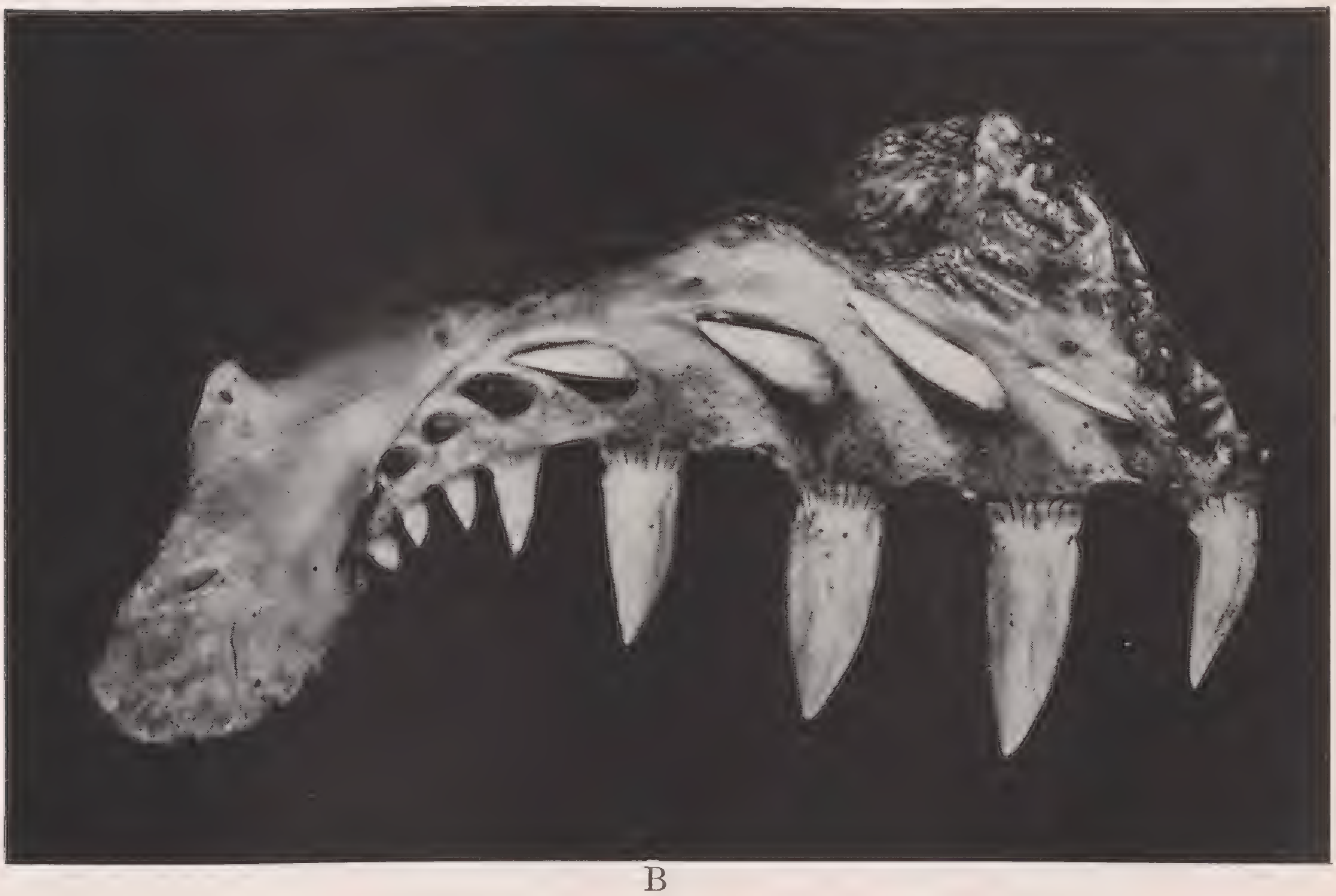
Ventral view of anterior portion of skull of *Hydrocyon lineatus* with the tooth-bearing premaxillæ and the hinged symphysis. $\frac{1}{1}$.



Two distal teeth (*A*) of right dentary of *Hydrocyon lineatus* compared with front (*B*) and side (*C*) views of a tooth of *Onchosaurus mira* (Leidy). $\frac{1}{1}$. Right lower jaw (*D*) of *Hoplias* ($\frac{3}{2}$), viewed from inside, and outer view of the largest anterior tooth (*E*). $\frac{4}{1}$.



A



B

Head of *Hydrocyon lineatus*. *A*, to illustrate the interlocking of the teeth when the mouth is closed; *B*, left premaxilla of *Hydrocyon lineatus*, viewed from inside ($\frac{3}{4}$), showing the full series of reserve teeth.

56.7(1161:67.5)

Article XXVII.— FOSSIL FISHES COLLECTED BY THE AMERICAN MUSEUM CONGO EXPEDITION.[1]

By L. Hussakof.

Plate LXXXVIII.

Among the materials collected by the American Museum Congo Expedition there is a small series of fossil fishes from two localities. One of these, Mission St. Gabriel, does not seem to have been previously known as a locality for fossils. The other, Landana (a Paleocene horizon), has already yielded invertebrates, fishes and the remains of a turtle.

I. Specimens from Mission St. Gabriel.

The Mission of St. Gabriel is situated on the right bank of the Congo, a few miles below Stanleyville. The bank of the river here consists of pale olive-colored shales, formerly quarried for building purposes, and which contain fossil fishes. During a short visit to this locality in April, 1915, Mr. Herbert Lang, the senior member of the expedition, collected a small lot of fragments of the rock bearing scales, head-bones, fin-rays, etc. The specimens apparently represent several fishes of different sizes, but all pertaining to a single species, an undescribed *Lepidotus*.

Lepidotus congolensis n. sp.

Cotypes.— (1) Disarranged scales on a piece of rock (Plate LXXXVIII, Fig. 8). (2) Left premaxilla, in inner view, on a piece of rock (Text Fig. 1). (3) Impression of outer face of the left suboperculum (Text Fig. 4). (4) Fragment of a head-bone, showing ornamentation (Plate LXXXVIII, Fig. 6).

Horizon.— Lualaba beds (probably Upper Triassic).

Locality.— Shores of the Congo, at Mission St. Gabriel, a few miles below Stanleyville.

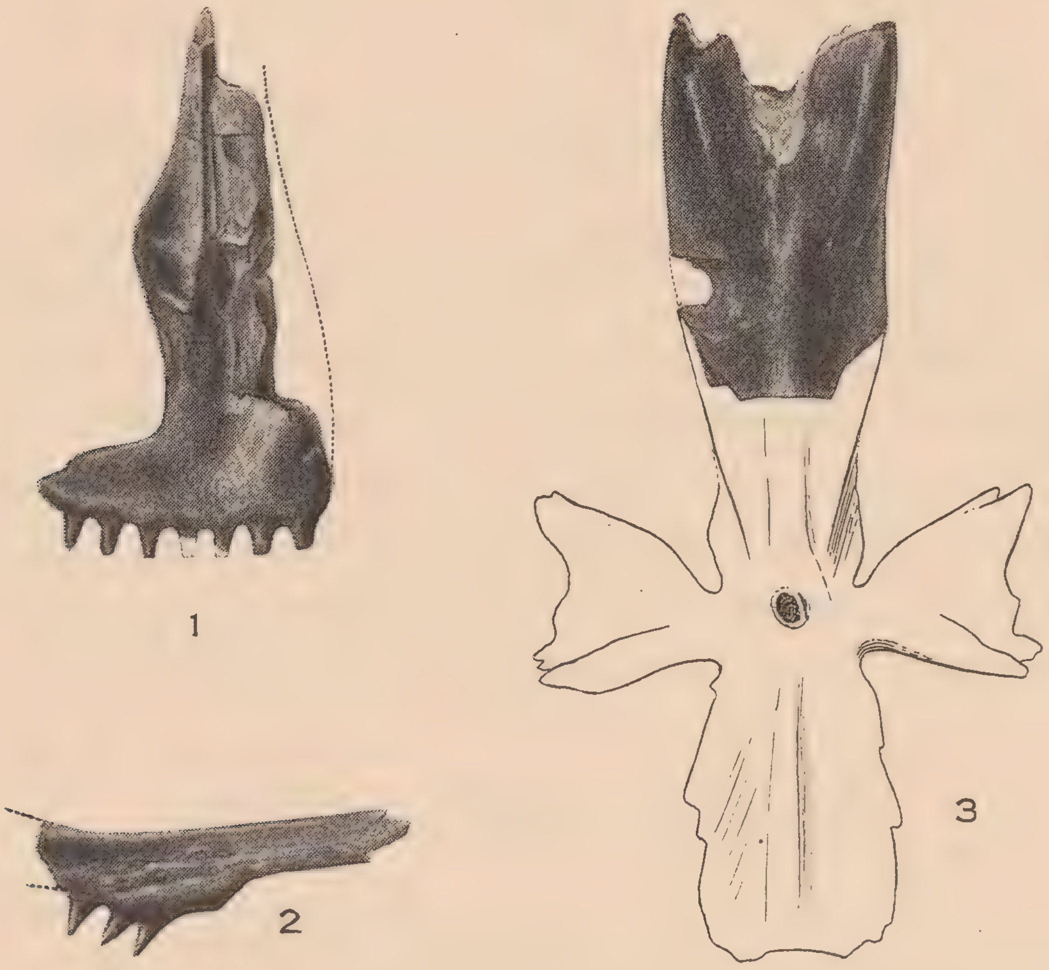
Diagnosis.— A species reaching a length of half a meter, known at present by detached head-bones, jaw elements and scales. Head-bones ornamented with small round tubercles, few and widely spaced in some places, numerous and densely crowded in others. Suboperculum elongate triangular (exclusive of vertical process), its depth, at $\frac{1}{3}$ the distance from the anterior margin, contained $1\frac{4}{5}$ in its length; exposed part with little ornamentation, only a few tubercles along inferior margin and vague suggestions of rugæ on middle portion; flange for overlap by operculum a little less than one-fourth the greatest depth of entire element. Marginal teeth of jaws elongate-conical, rather robust, smooth. Premaxilla with seven teeth. Scales smooth, their posterior margins entire, or, in some of the principal flank scales, with two tooth-like processes, one at the inferior angle, the other a short distance above it. Scales immediately behind pectoral arch 1$\frac{2}{3}$ times as deep as wide (exposed portion). Fin-fulcra large.

---

[1] Scientific Results of the American Museum of Natural History Congo Expedition. Ichthyology, No. 3.

This is the first species of *Lepidotus* to be described from the Congo region. A single scale referable to this genus was figured by Leriche (1911, pl. x, fig. 2), from a locality named Kindu. This scale was about as large as the flank scales here described, smooth, and with two small tooth-like processes along the lower portion of the posterior margin. Very probably it belongs to the species here described.

Lepidotus congolensis differs from the other species of *Lepidotus* discovered within the past few years in Central Africa — *L. manni* (Hennig, 1913) from Adamaua, Kamerun, and *L. minor* Ag. from Tendaguru, East Africa (Hennig, 1914). As far as may be judged from the remains available for comparison, the species is close to *L. latifrons* Woodward (1893), from the Oxford Clay.

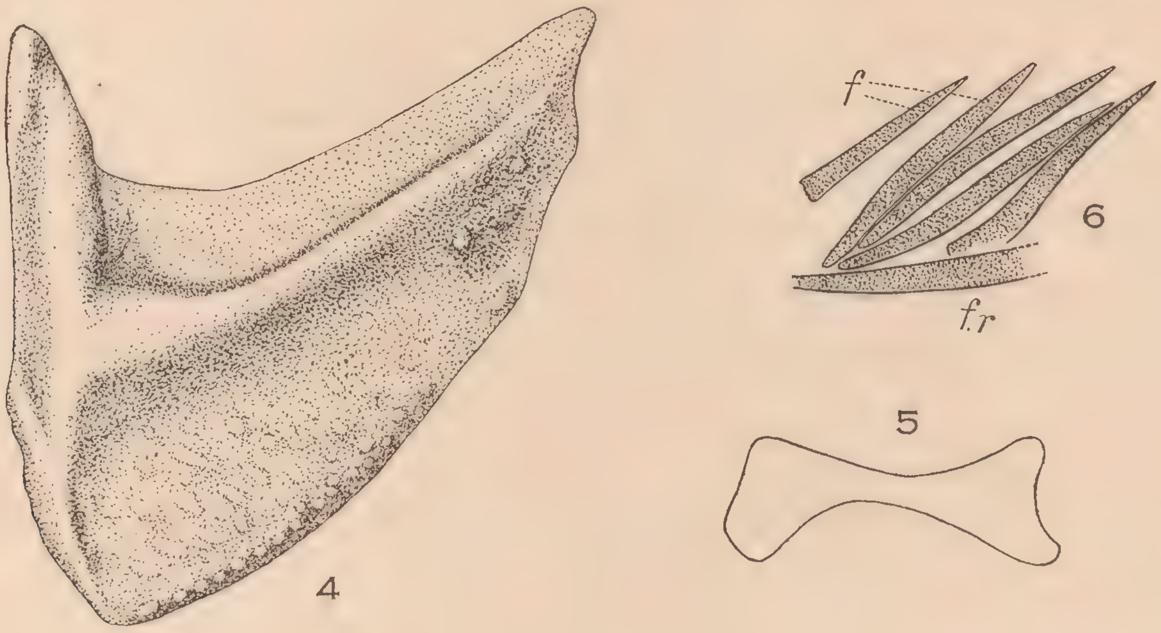


Figs. 1–3. *Lepidotus congolensis* n. sp. 1. Left premaxilla, in inner view. Cotype, nat. size. 2. Anterior extremity of a maxilla, the teeth restored from counterpart. Nat. size. 3. Fragment of parasphenoid. $\times \frac{1}{2}$.

As to the geological horizon of the specimens: *Lepidotus congolensis* is evidently derived from the Lualaba formation, the middle one of the three formations or stages recognized in the Congo basin (J. Cornet, 1893–94). This is shown by the similarity of the matrix and by the apparent specific identity of the specimens with the scale referred to above as described by Leriche from Kindu, which locality is known to be a Lualaba horizon; also from the fact that the Lualaba beds are well developed within a few miles of Mission St. Gabriel, *e. g.*, at Stanleyville (Cornet, 1908–9), and at Stanley Falls (G. Passau, 1908–9). The Lualaba formation has been correlated with the Upper Triassic (see especially Leriche, 1911, p. 195), so that we may provisionally regard that as the horizon of *L. congolensis.*

We may now comment briefly on some of the morphological features of the specimen.

Head Plates.— A complete cranial plate, probably a parietal, and a fragment of another are preserved. They are figured (Plate LXXXVIII, Figs. 6, 7) to illustrate the ornamentation of the head-bones in the species. The complete element probably belongs to a young fish as shown by the pointed, unworn condition of the tubercles, while the fragment represents a head-bone of a larger individual.



Figs. 4–6. *Lepidotus congolensis* n. sp. Nat. size. 4. Left suboperculum. Cotype. Drawn from wax squeeze of the impression in matrix. 5. Outline of one of pelvic basalia. 6. Fulcra (*f*) attached to a front fin-ray (*f. r*), somewhat disarranged.

The left suboperculum is represented by a very perfect impression of its outer face. Fig. 4 is drawn from a wax squeeze of this impression. The element resembles the one figured by Woodward (1893, pl. l, fig. 1) in that remarkable naturally disarticulated head of *Lepidotus latifrons* upon which our knowledge of the cranial morphology of the genus so largely rests. The element is somewhat less than half the size of that of *L. latifrons.* It is 45 mm. in length by 26 mm. in depth (measured on a line parallel to the anterior margin and at a point where the opercular overlap flange is deepest). The overlap flange is 7 mm. at its widest part and proportionally not as deep as in *L. latifrons.* The exposed portion of the plate bears very little ornamentation, merely a few tubercles in a row along the lower margin, and vague suggestions of rugæ on the middle of the plate. In *L. latifrons,* on the other hand, the plate is densely covered with tubercles.

Besides the suboperculum there is present half of a preoperculum, probably the upper arm of that of the left side (Plate LXXXVIII, Fig. 8, *p. op*).

In Fig. 3 is shown a portion of a parasphenoid. It is completely out of matrix and agrees, as far as it goes, with the one figured by Woodward in the specimen already referred to (1893, fig. 3), differing only in the fact that the lateral margins do not converge as rapidly as in that form.

Jaw elements.— One of the premaxillæ is preserved (Fig. 1); it is one of the most perfect specimens of the kind ever described, and shows prettily the structure of this bone in *Lepidotus.* A careful comparison with its homologue in *Amiatus* proves it to be that of the left side, shown in inner view. The tooth margin is 19 mm. in length and bears seven teeth. These are elongate-conical in form, like those of *Amiatus,* but more robust. A few of them which appear as if broken, are really worn down by use, thus proving that the element comes from an old individual.

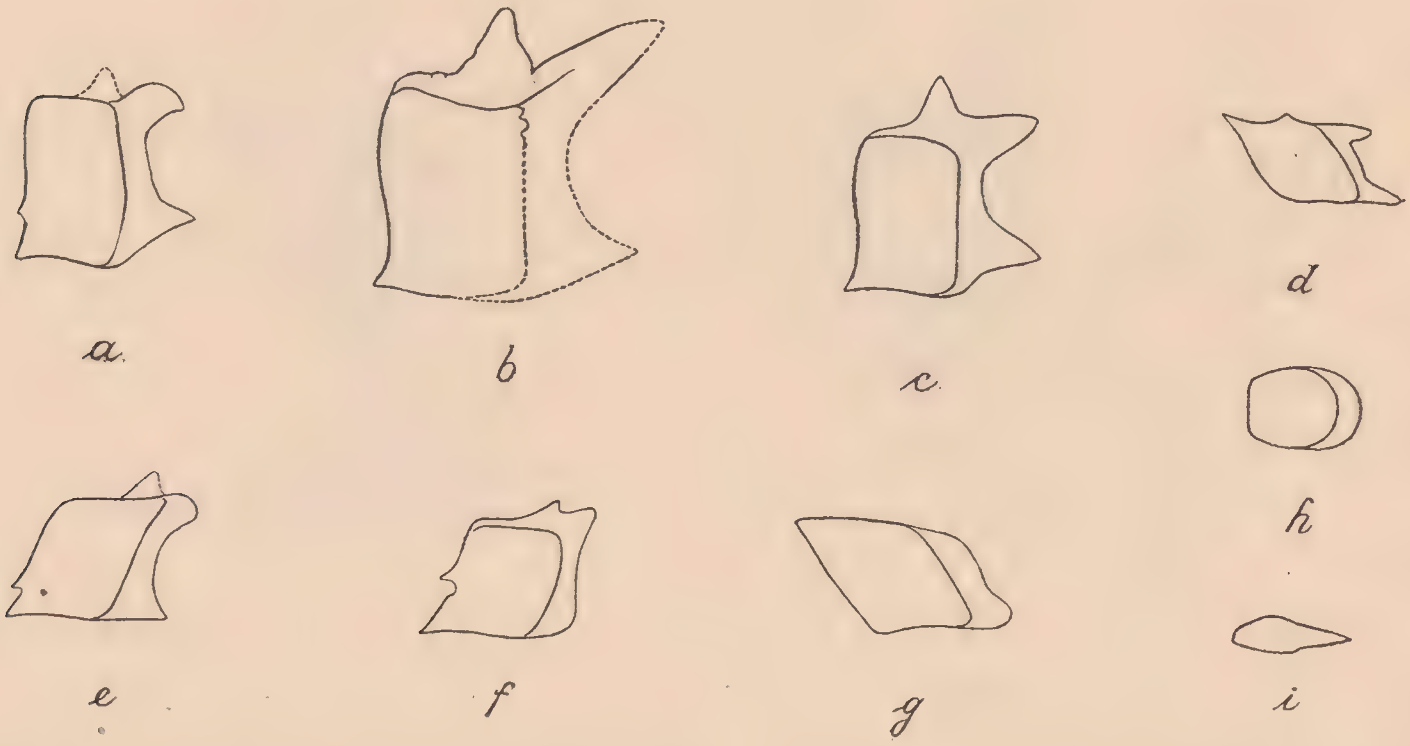


Fig. 7. *Lepidotus congolensis* n. sp. Scales from different parts of fish, some of them (*a, e, f*) showing the two processes along posterior margin. Natural size. *a*, deepened flank scale from behind pectoral arch. *b*, one of the largest flank scales found. *c*, deepened scale without posterior denticles from a row further back than that of *a*. *d*, scale from anal region. *e*, flank scale showing well the two posterior denticles. *f*, scale from lateral line, as shown by the semicircular excavation of hinder margin. *g*, scale from anal region. *h*, from median line of back. *i*, biserial fulcral scale from base of one of unpaired fins.

The anterior extremity of a maxilla with the three anteriormost teeth is also preserved (Fig. 2). The teeth are like those on the premaxilla.

Pelvic arch.— A noteworthy element present is one of the pelvic basalia, shown in outline in Fig. 5. It is a very thin bone, 23 mm. in length, and of the same general form as that of *Amiatus.* This seems to be the first time that this element has been noted in *Lepidotus.*

Scales and Fulcra.— A number of scales from different parts of the body are well shown in one of the cotypes (Plate LXXXVIII, Fig. 8). Those of the rows immediately behind the pectoral arch are about one and two-thirds as deep as wide. The exposed or enameled surface is in all cases perfectly smooth. In Fig. 7 a number of scales are shown to illustrate especially the posterior margin. In some this margin is entire; in others, the postero-inferior angle is drawn out to a sharp tooth-like process, with, in some cases, a second small cusp a short distance above it. The scales with the two tooth-like processes resemble a scale of *Lepidotus unguiculatus* Agassiz, figured by Woodward (1890, pl. iii, fig. 8) from the Great Oolite (Bathonian) near Oxford. But in the latter the denticles on the posterior margin are much longer and more acute. In most specimens of *L. unguiculatus,* moreover, there are three or more denticulations, whereas in *L. congolensis* there seem never to be more than two.

Some of the scales of the median line of the back (Fig. 7*h*) are present as well as some groups of fulcra from the margins of the fins. In Fig. 6 is shown a group of fin-fulcra as preserved in connection with a front fin-ray and only a little shifted from their natural positions. This shows clearly that the species had large fulcra, the larger ones like strong fin-spines.

II. Specimens from Landana.

Landana is a post situated on the coast, about 65 miles north of the mouth of the Congo. Mr. James P. Chapin obtained a few shark teeth and fish fragments here, among them the first indication of teleosts in the formation.

Five species of fishes, all elasmobranchs, are already known from this formation (Leriche, 1913), namely: *Hypolophites mayombensis* n. sp., *Myliobatis dispar* n. sp., *Ginglymostoma* sp., *Odontaspis macrota* and *Lamna appendiculata.* This is hardly more than an earnest of what is to be expected when the beds come to be carefully searched for fossils. But these species are a sufficient key to the age of the formation, and Leriche (1913a) concluded from them that it is Paleocene, and correlated approximately with the Montien stage of northern France and Belgium.

The species collected by Mr. Chapin are the following:

Odontaspis macrota (*Agassiz*).

Plate LXXXVIII, Figs. 1, 1*a*.

One tooth, from the front part of the jaw; height, 19 mm. The tooth is subulate, sigmoidal in side view, and with sharp lateral keels. The inner face bears faint, somewhat undulating, vertical striæ, most prominent near the base. There is a pair of minute lateral denticles which are broader than high.

It is somewhat difficult to distinguish single teeth of this species from *Odontaspis elegans.* But the present tooth agrees well with the one from the same beds figured by Leriche under the above name (1913, p. 78, pl. x, fig. 2) except that it is smaller and more pointed.

Lamna appendiculata (*Agassiz*).

Plate LXXXVIII, Figs. 2, 2*a*, 3, 3*a*.

Two teeth; one 22 mm. in height, from the front half of the jaw, and one, an oblique tooth, 11 mm., from the angle of the jaw. They agree well with the diagnosis of this species given by Woodward (Catal. Fos. Fishes, vol. 1, p. 393).

Rhinoptera sp.

Plate LXXXVIII, Figs. 4, 4*a*.

A single tooth, 13 mm. wide and 4 mm. long. I refer it to *Rhinoptera* with some reservation, as possibly it may represent a juvenile specimen of *Myliobatis* of which one species has been recorded and there are probably also others in these beds.

Teleostean vertebra.

Plate LXXXVIII, Figs. 5, 5*a*.

A small biconcave vertebra, 8 mm. in diameter and 6 mm. in length This is the first indication of teleostean fishes in the Landana beds.

PAPERS CITED.

CORNET, J.

1893–4. Les formations post-primaires du Bassin du Congo. Ann. Soc. Géol. Belgique, XXI, Mémoires, 262–269.

1908. Les couches du Lualaba (communication préliminaire). *Ibid.*, XXXV, Bulletin, 99–100.

1908–9. Sur la géologie du Lualaba, entre Kasongo et Stanleyville. *Ibid.*, Bulletin, 231.

HENNIG, EDWIN.

1913. Mesozoische Wirbeltierfunde in Adamaua. Beitr. geol. Erforsch. d. deut. Schutzgebiete, 1913, 10–29, pl. i.

1914. Die Fischreste unter den Funden der Tendaguru-Expedition. Arch. f. Biontologie, III, 293–312, pl. xxiii.

LERICHE, M.

1910. Sur les premiers poissons fossiles rencontrés au Congo belge, dans le système du Lualaba. Comptes rend. Acad. Sci. Paris, CLI, 840–1.

1911. Les poissons des couches du Lualaba (Congo belge). Rev. Zool. Africaine, I, 190–197, pls. ix–x.

1913. Les poissons paléocènes de Landana (Congo). Ann. du Musée du Congo Belge, Géol. Paléont. Miner., ser. iii, I, 69–80, pls. viii–x.

1913a. Les gisements de poissons paléocènes et éocènes de la côte occidentale d'Afrique. *Ibid.*, 81–91.

PASSAU, G.

1908–9. Note sur la géologie de la zone des Stanley-Falls et de la zone de Ponthierville, Province orientale (Congo belge). Ann. Soc. Géol. Belgique, XXXVI, Mémoires, 221–238.

WOODWARD, A. S.

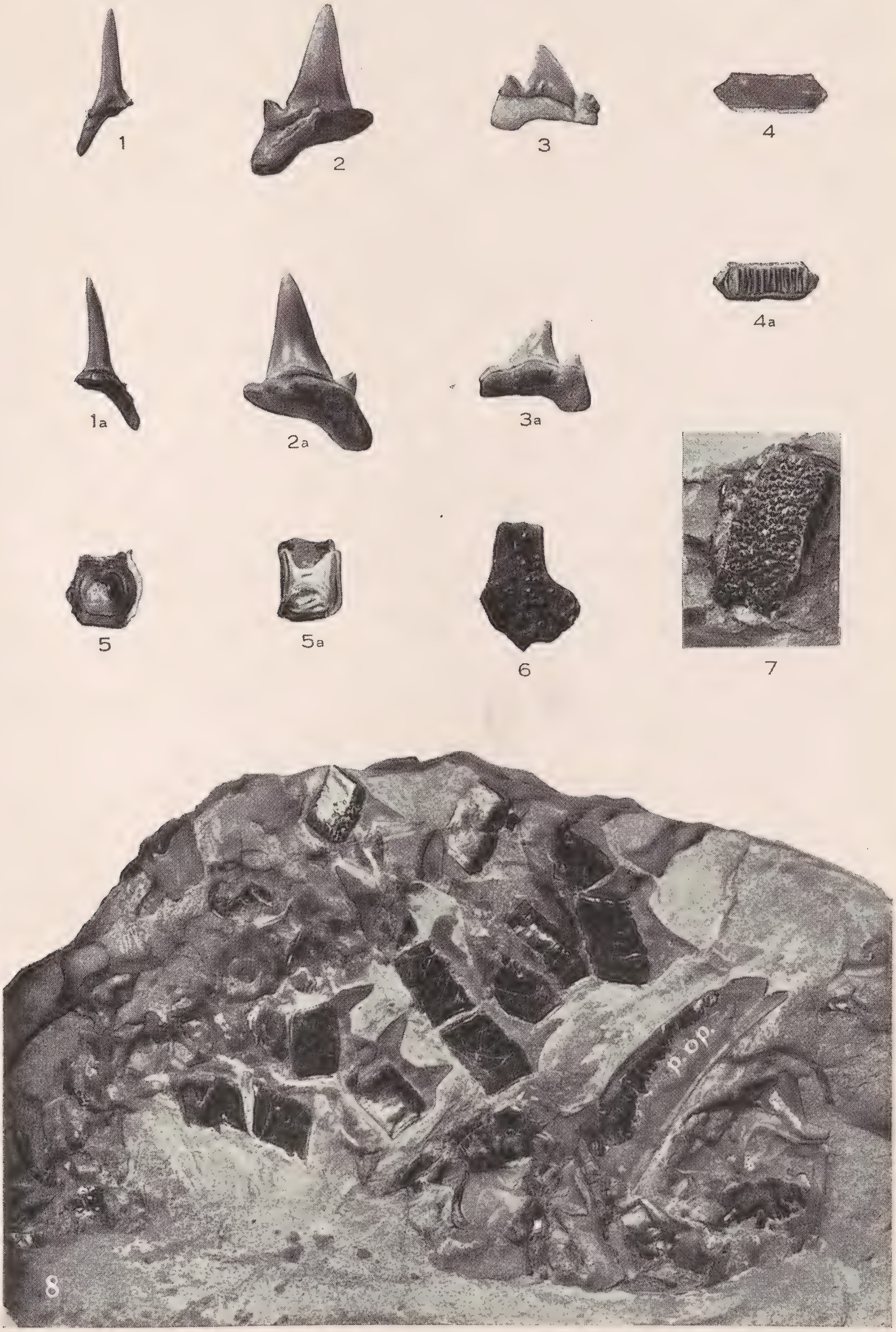
1890. A synopsis of the fossil fishes of the English Lower Oolites. Proc. Geologists' Assoc., XI, 285–308, pl. iii.

1893. On the cranial osteology of the Mesozoic ganoid fishes, *Lepidotus* and *Dapedius*. Proc. Zool. Soc. London, 1893, 559–565, pls. xlix-l.

EXPLANATION OF PLATE LXXXVIII.

Figs. 1, 1a. *Odontaspis macrota* (Ag.). Outer and inner views.
2, 2a, 3, 3a. *Lamna appendiculata* (Ag.). Outer (2, 3), and inner (2a, 3a) views.
4, 4a. *Rhinoptera* sp.
5, 5a. Teleostean vertebra, sp. indet.
1–5a, Paleocene; Landana, Congo. Natural size.

Figs. 6–8. *Lepidotus congolensis* n. sp.
Lualaba beds (Upper Triassic); Mission St. Gabriel, Congo.
6. Cotype. Fragment of cranial plate with characteristic ornamentation. Nat. size.
7. Cranial plate (parietal?) of a smaller individual than preceding. Nat. size.
8. Cotype. Scales and fragments of plates. *p. op*, part of a preoperculum. $\frac{7}{8}$.



FOSSIL FISHES FROM THE BELGIAN CONGO.

59.9.33S:14.71

Article XXVIII.— THE SKELETAL CHARACTERS OF *SCUTISOREX* THOMAS.[1]

BY J. A. ALLEN.

PLATES LXXXIX–XCII; TEXT FIGS. 1–8.

The genus *Scutisorex* Thomas was founded in 1913 [2] for a large species of African shrew, previously described by him as *Sylvisorex somereni*,[3] based on a single specimen (skin and skull) from Uganda. A second species of the genus was described by the same author five years later as *Scutisorex congicus*,[4] based also on a single specimen (skin and skull) collected at Medje, Upper Ituri River, Belgian Congo. Thirty-seven topotypes of this species, collected by Lang and Chapin on the American Museum of Natural History Congo Expedition, were recently recorded by Hollister in this 'Bulletin.' [5]

The "chief characters" of *Scutisorex* are given as "the long thick fur, quite different from the short velvety coat of *Sylvisorex*, and the great development of the cranial ridges, as compared with the practically smooth unridged skull of *Sylvisorex*." Fortunately in addition to the large series of skins and skulls mentioned above, the Lang-Chapin collection contains a specimen in alcohol, one complete skeleton and six other skeletons more or less incomplete. This material shows that the external and cranial characters fail to reveal the existence in *Scutisorex* of an extremely specialized vertebral column, differing surprisingly in structure from that of *Sylvisorex* or *Crocidura*, and even from that of any known insectivore.

The skull and limb bones are not essentially different from those of other Crocidurinæ. The teeth, in comparison with those of the larger species of *Crocidura* (as, *e. g.*, the *C. nyansæ* group) are markedly reduced in size but not otherwise essentially modified. The skull, however, is differently proportioned, the preorbital portion being narrowed and the postorbital greatly broadened in comparison with that of *Crocidura*, in which the maxillar breadth is about 32 per cent. and the mastoid breadth 36 per cent. of the condylobasal length, while these proportions in *Scuti-*

---

[1] Scientific Results of the American Museum of Natural History Congo Expedition. Mammalogy, No. 3.

[2] Ann. and Mag. Nat. Hist. (8), XI, pp. 320–321, March, 1913.

[3] *Ibid.*, VI, p. 113, July, 1910.

[4] *Ibid.*, XVI, p. 470, Dec., 1915.

[5] Bull. Amer. Mus. Nat. Hist., XXXV, pp. 663–680, pll. vii–xi, Oct. 21, 1916. *Scutisorex congicus* Thomas, pp. 673–674, pl. xi, fig. 2 (half-tone of animal, about $\frac{1}{2}$ nat. size).

sorex are respectively 30 and 46 per cent. In *Crocidura* the dorsal outline of the skull is straight, the depth of the skull at the beginning of the molariform series being the same as at the mastoid region. In *Scutisorex* the depth of the rostrum is much less than in *Crocidura,* and at the mastoid region much greater. In *Scutisorex* the braincase is strongly roughened, the lambdoid crest is heavily produced and the mastoid region greatly expanded. In *Crocidura* the braincase is smooth, the lambdoid rather weakly developed, and the mastoid breadth of the skull is but little greater than the maxillar breadth. (Compare Figs. 1–3.)

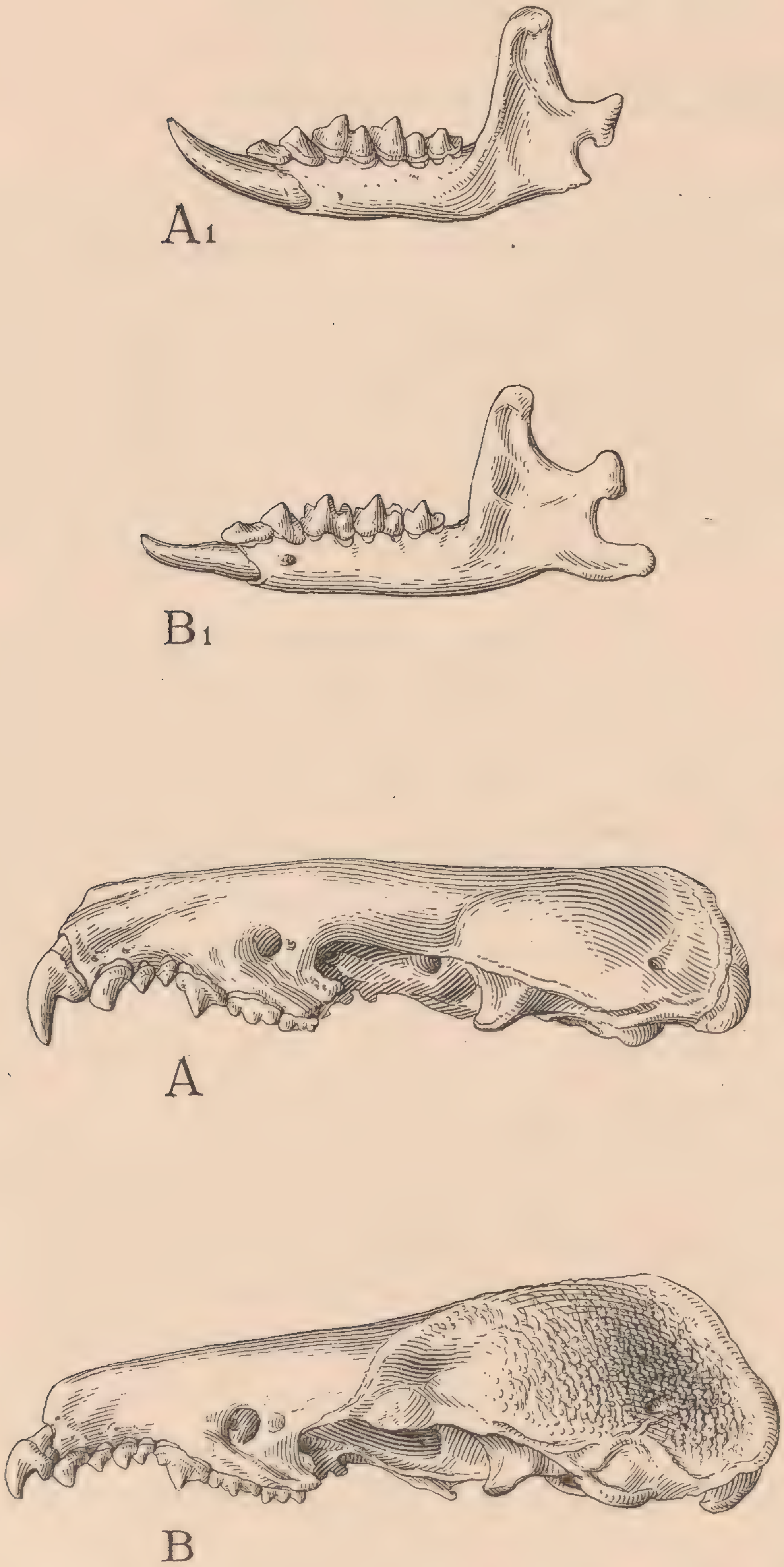


Fig. 1. Skulls and lower jaws (side view) of *Crocidura* and *Scutisorex*. All $\frac{2}{1}$.

A and A^1, *Crocidura nyansæ kivu* (♂ No. 48497, Medje, April 8, 1910); *B* and B^1, *Scutisorex congicus* (♂ No. 51311, Medje, April, 1910).

The measurements of the skull (No. 51311) of the skeleton constituting the principal basis of the description of the axial skeleton given below are as follows: Condylobasal length (to front of incisors) 32 mm.; total length, 32.4; interorbital breadth, 8.4; mastoid breadth, 13.7; maxillar breadth, 9.8; breadth at base of incisors, 3.1; breadth across occipital condyles, 8; breadth outside to outside of zygomatic processes of squamosal, 10.2; transverse breadth of foramen magnum, 4.7; axial breadth of foramen magnum, 3.3; upper toothrow (including canines), 14.1; maxillar series (first unicuspid to m^3), 10; molar series, 5.3; mandible to tip of incisors, 22, to base of incisors, 18.4; angle to condyle, 5.5; depth at coronoid, 8; toothrow to tip of incisors, 13.1, excluding incisors, 9.6.

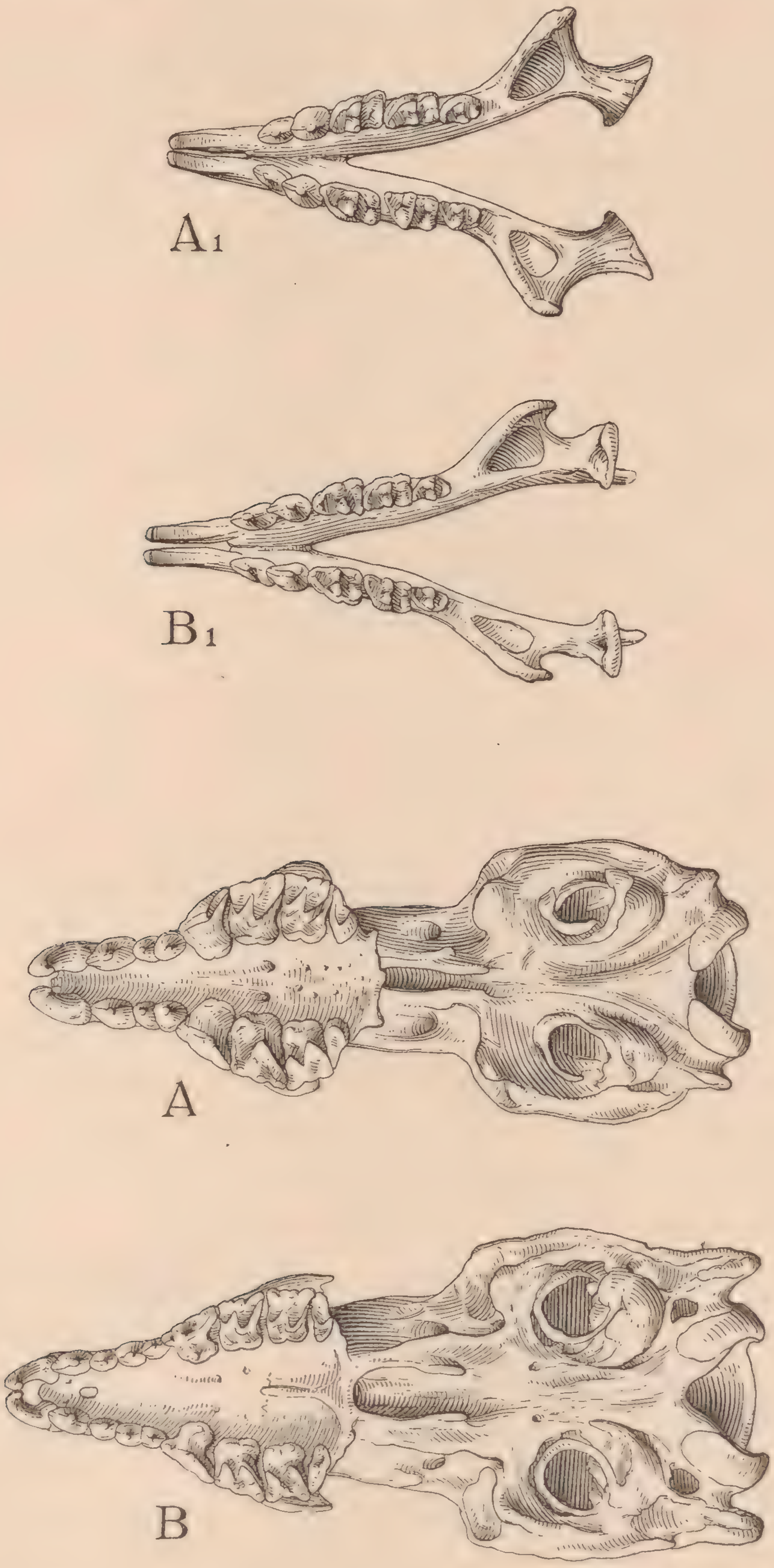


Fig. 2. Skulls (ventral view) and lower jaws (dorsal view) of *Crocidura* and *Scutisorex*. All $\frac{2}{1}$. *A* and A^1, *Crocidura nyansæ kivu:* *B* and B^1, *Scutisorex congicus*. Same specimens as in Figs. 1 and 3.

Axial skeleton, total length, 232 mm., made up as follows: skull, 32; cervical vertebræ, 14; thoracic vertebræ, 25; lumbar vertebræ, 33; sacral vertebræ, 17; caudal vertebræ, 111.

Scutisorex has, in comparison with *Crocidura*, a much heavier body and correspondingly more strongly developed limbs. While the length of the skull in *Scutisorex* is practically the same as in *Crocidura nyansæ,* it is more massively built, the body is several times greater in bulk than in *C. nyansæ,*

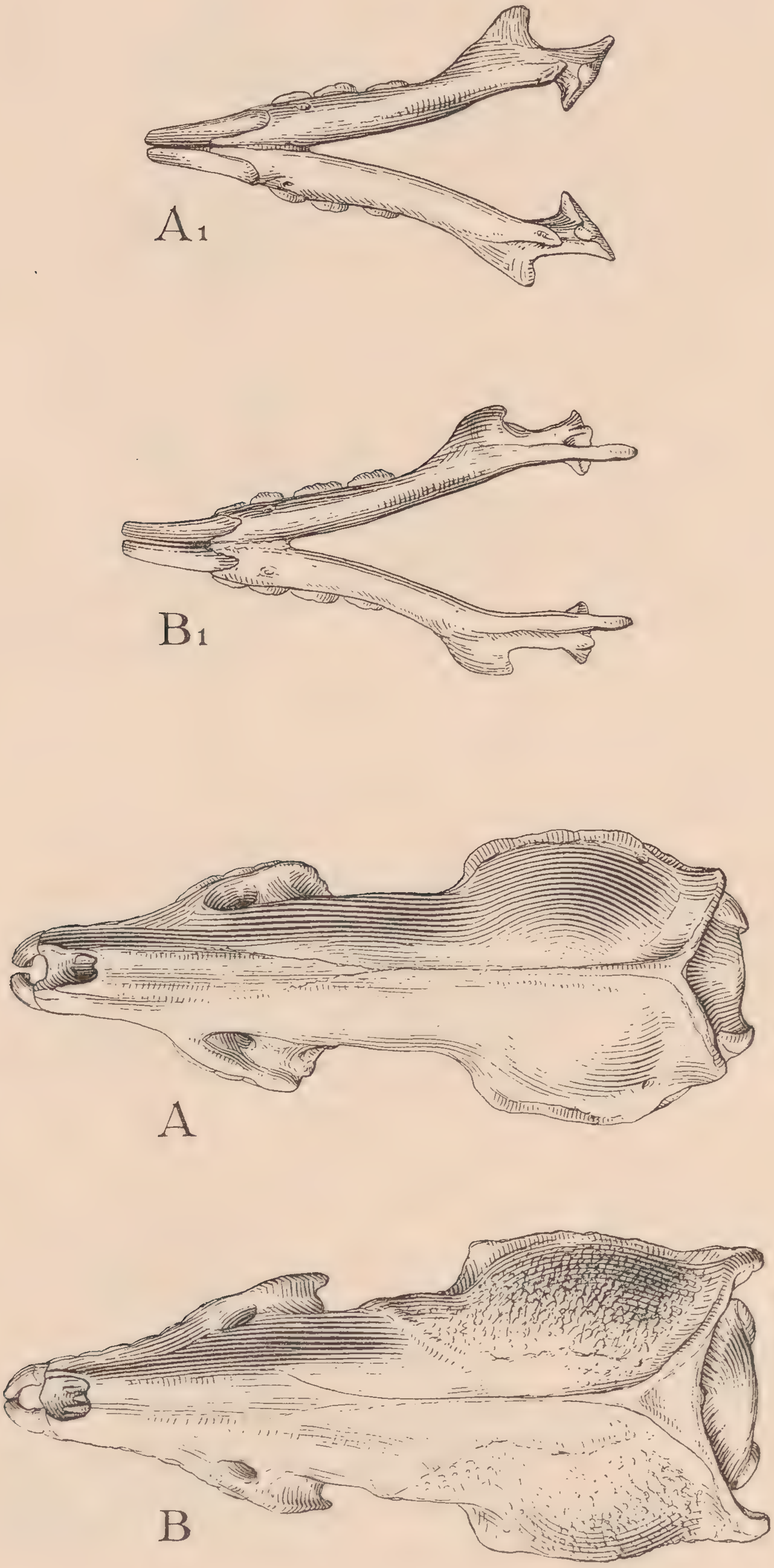


Fig. 3. **Skulls** (dorsal view) and lower jaws (ventral view) of *Crocidura* and *Scutisorex.* All $\frac{2}{1}$. *A* and A^1, *Crocidura nyansæ kivu; B* and B^1, *Scutisorex congicus.* Same specimens as in Figs. 1 and 2.

and the limbs are proportionally similarly developed, the limb bones being about one-fourth longer and correspondingly more robust. The details of structure, however, are essentially the same, developed on a much larger scale.

VERTEBRAL COLUMN.

For convenience in preparing the present account of the principal characters of the axial skeleton in *Scutisorex congicus,* the skeleton of one of the larger species of *Crocidura* (*C. nyansæ*) has been taken as a suitable standard for comparison.

Vertebral formula.— The vertebral formula of *Scutisorex* differs strikingly from that of *Crocidura,* and also from that of insectivores in general, through the lengthening of the lumbar series from 6 (sometimes 5) to 11[1], which latter has been found to be the constant number in five skeletons of *Scutisorex congicus,* or nearly twice the usual number in the Soricidæ and allied families. This in itself is a surprising and noteworthy feature; but it is combined with an unique specialization of the vertebræ themselves of the whole dorso-lumbar series. The vertebral formula of *Scutisorex,* in comparison with that of *Crocidura nyansæ,* is as follows:

	Cervical	Dorsal	Lumbar	Sacral	Precaudal	Caudal
S. congicus	7	14	11	5	37	23?
C. nyansæ	7	15[2]	6	5	33	19

General features.— As shown in the accompanying illustrations (Figs. 1–8), the vertebral column in *Crocidura* is typically soricine — slender and lightly constructed, with slight development of the apophysial elements, and nearly uniform in the transverse and vertical diameters of the vertebræ from the anterior cervical to the end of the lumbar series. In *Scutisorex* the vertebral column is heavily built, the vertebræ rapidly increase in both diameters from about the middle of the dorsal series to the middle of the lumbar, and decline in size only slightly thence to the end of the lumbar series, as shown in the following table of measurements and in Text Figs. 5–8 and Plates LXXXIX and XC.

The unique feature of the vertebræ in *Scutisorex* is the profuse development of interlocking spines, arising mainly from their lateral aspects, but also present on the dorsal and ventral, apparently as yet unrecorded for any mammal. The latero-ventral borders of the vertebræ from about the 7th dorsal to the last lumbar are so enormously produced that this part of the vertebral column, as seen from below, is deeply concave or trough-shaped, suggesting the simile of a canoe. These spines are directed hori-

---

[1] Five skeletons have each 11, one has only 10, but in this one the last two thoracics are somewhat abnormal, apparently through injury in life. The other skeleton has the dorso-lumbar series of vertebræ incomplete.

[2] In two specimens; given as 14 in some of the other species of *Crocidura.*

Comparative Measurements[1] *of Vertebræ in Scutisorex and Crocidura.*

	Scutisorex congicus No. 51311		Crocidura nyansæ kivu No. 48947	
	Transverse	Vertical	Transverse	Vertical
4th Cervical	6.6	5.0		
1st	7.5	4.5	5.1	5.0
7th “	7.5	3.5	4.5	3.3
14th “	9.5	6.4	4.1	3.5
4th Lumbar	11.0	7.5	4.6	3.0
11th “	8.2	7.5	—	—
1st Caudal	5.0	4.5	3.8	3.8

zontally, those of one vertebra interlocking closely with those of the next adjoining vertebræ. They seem not to be morphologically homologous with any of the ordinary vertebral elements; they suggest the exostosis often present in vertebrates as a senile or pathological condition. Possibly in the present case they may be construed as a normal exostosis, the function of which is to add strength and rigidity to the dorso-lumbar portion of the vertebral column. The function or purpose served can be determined only by full knowledge of the habits of the animal and study of its movements in life.

Cervical Vertebræ.— Except in their relatively much larger size, and the stronger development of the transverse processes, this series agrees very closely with the cervicals in the genus *Crocidura*, and consequently do not require consideration in detail. The ventral surface of the centrum, however, is flat, with a low median spine (hypapophysis) on the 2d, 3d and 4th, directed backward, but absent on the 5th, 6th and 7th. The enlarged transverse process of the 6th is similar in form to the same process in *Crocidura* but developed to a greater degree.

Dorso-lumbar series.— These can best be considered together, since the peculiar conditions which reach their maximum development in the lumbar series begin near the middle of the dorsal series.

The spinous process is rudimentary on the 1st dorsal, becomes a little larger on the 2d, and reaches its maximum size on the 3d; it decreases in size on the 4th, 5th and 6th, and is rudimentary from the 7th to the 14th, on which it is seen as a small point at the posterior border of the vertebra, horizontal in direction and imbricating the front border of the succeeding

---

[1] Measurements are in millimeters.

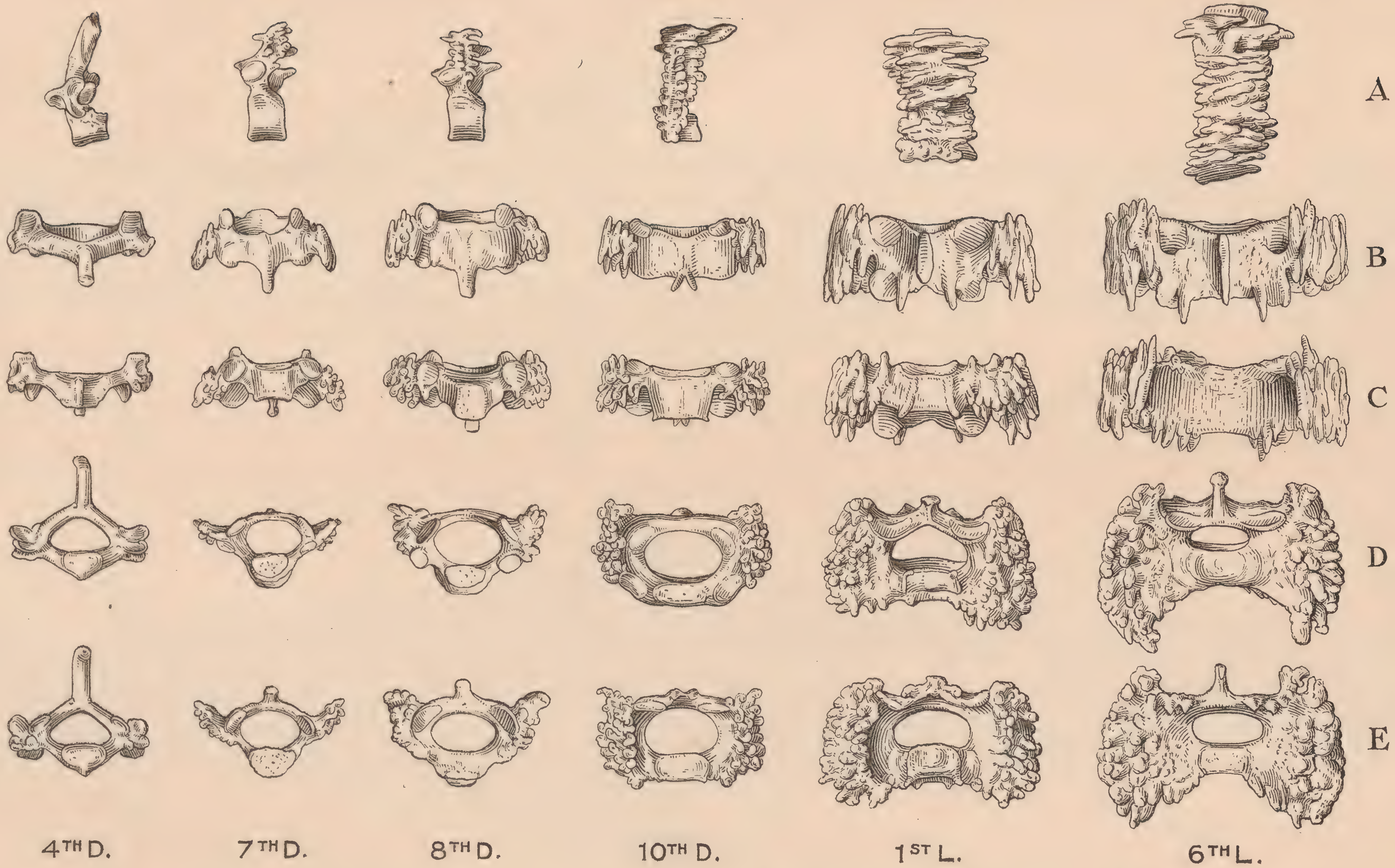


Fig. 4. Vertebræ of *Scutisorex congicus*. From a disarticulated skeleton (No. 48452, Bafwabaka, Jan. 5, 1910). All $\frac{2}{1}$.
From left to right, 4th, 7th, 8th and 10th dorsals, and 1st and 6th lumbars. *A*, lateral, *B*, dorsal, *C*, ventral, *D*, anterior, *E*, posterior views.

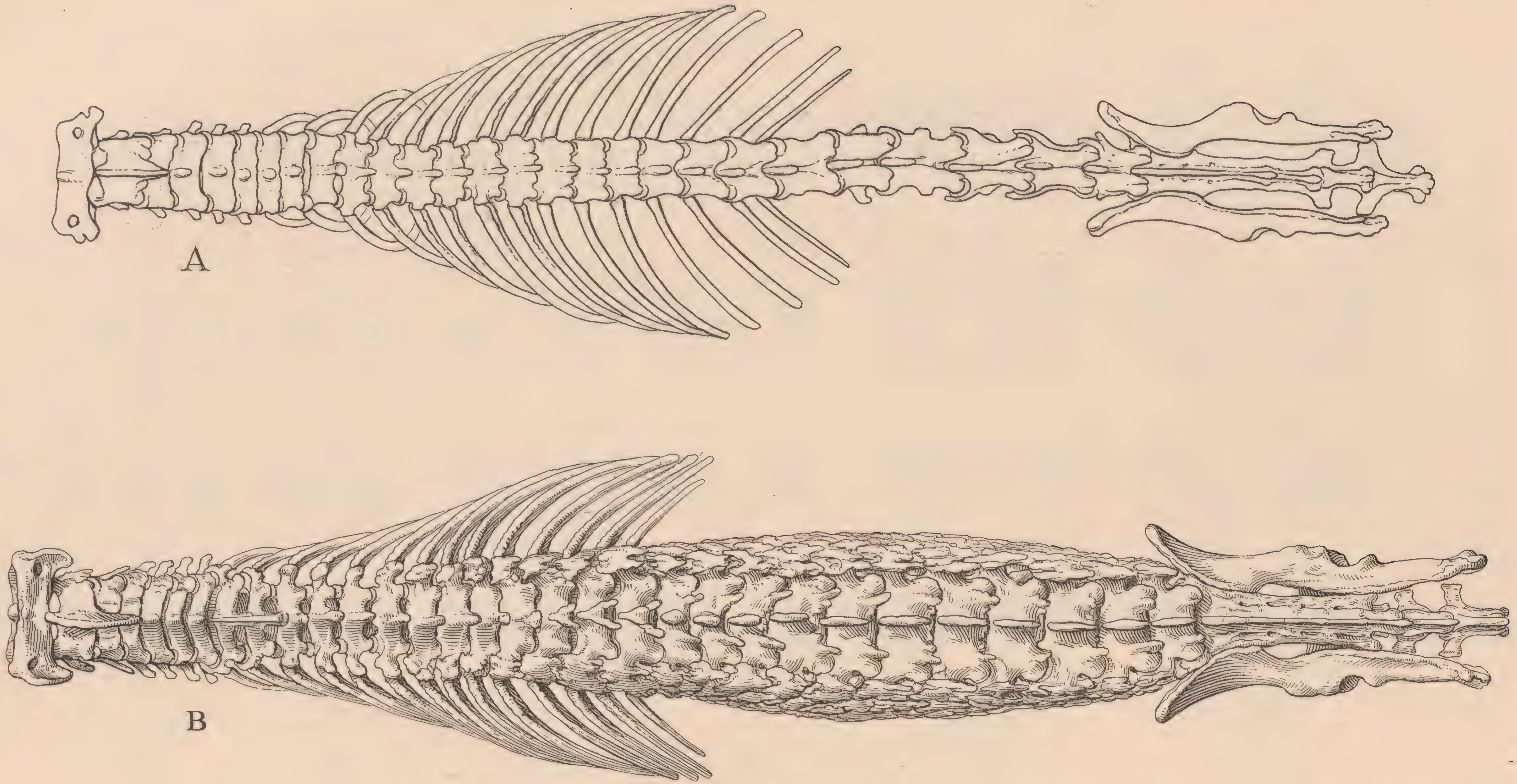


Fig. 5. Vertebral columns, dorsal view; *A*, *Crocidura nyansæ kivu*, *B*, *Scutisorex congicus*. Same specimens as skulls (Figs. 1–3). $\frac{2}{1}$.

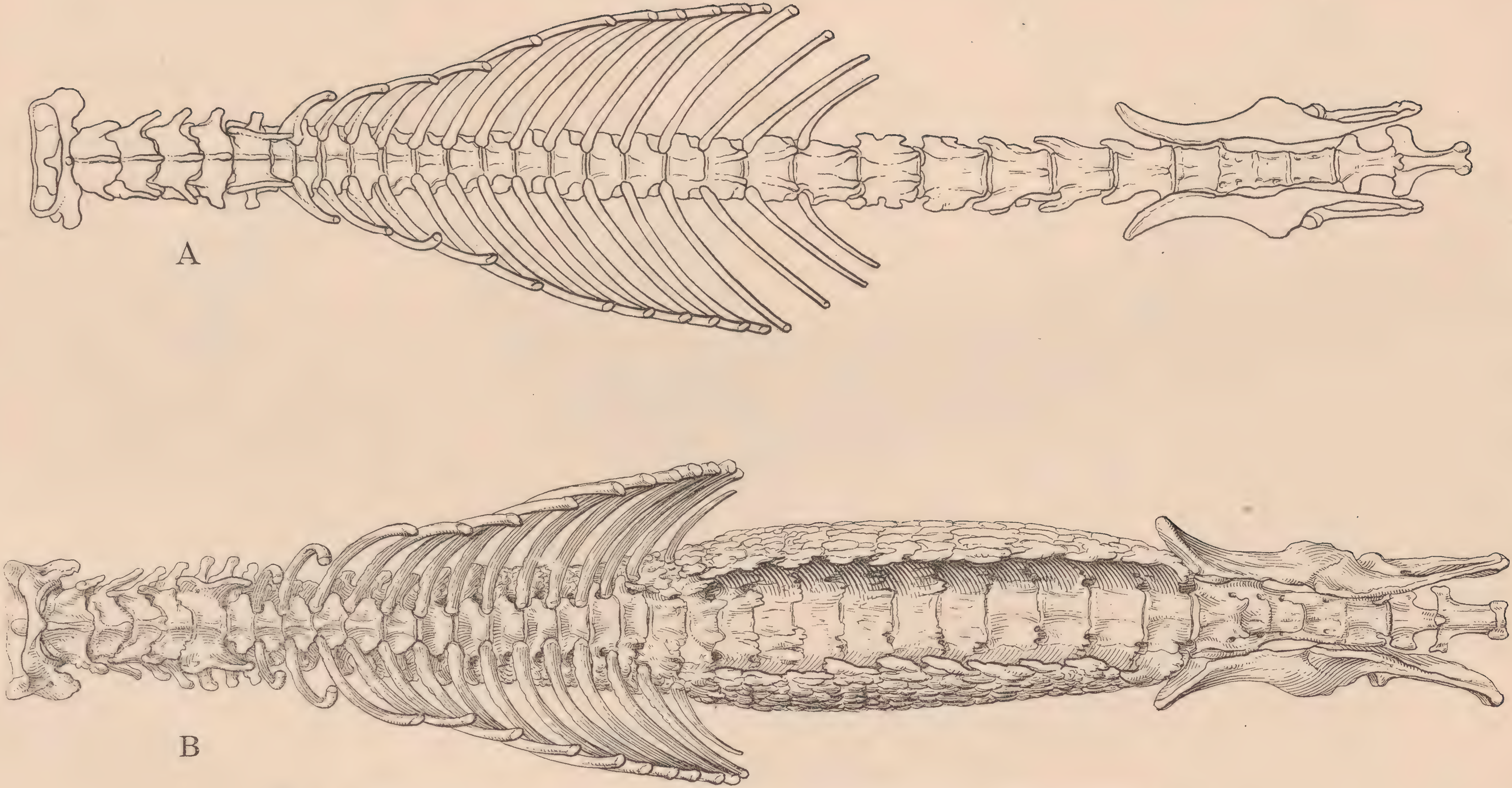


Fig. 6. Vertebral columns, ventral view, of (*A*) *Crocidura* and (*B*) *Scutisorex*. Same specimens as Fig. 5. $\frac{2}{1}$.

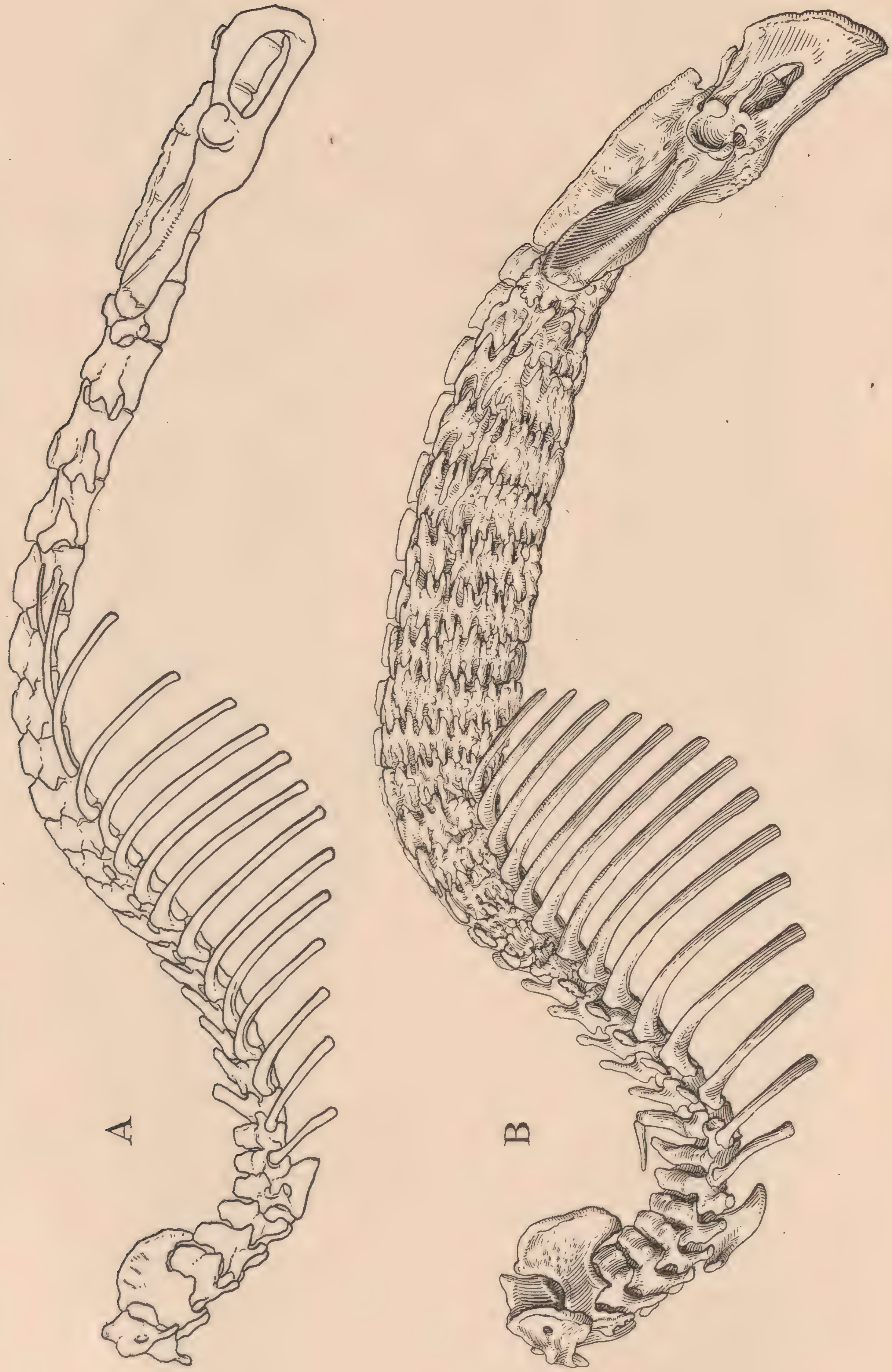


Fig. 7. Vertebral columns, lateral view, of (A) *Crocidura* and (B) *Scutisorex*. Same specimens as Figs. 5 and 6. $\frac{2}{1}$.

vertebral segment. On the 12th, 13th, and 14th, it is forked or v-shaped at the caudal end.

In the lumbar series the spinous process of the 1st is a low oval knob; on the rest of the series it is strongly developed as a subquadrate vertical lamina, the superior border straight, so that the series forms a low, nearly even median crest, with a slight vacuity between the processes at the junctions of the vertebral segments. The small accessory spines, or 'anapophyses,' described above as appearing on the last three dorsals, continue on either side of the spinous processes as low spicules directed horizontally backward, and slightly overlap the front border of the succeeding vertebra. From about the 5th or 6th of the series they tend, at the posterior end, to become double, through the development of a smaller spine external to the main 'anapophysis.'

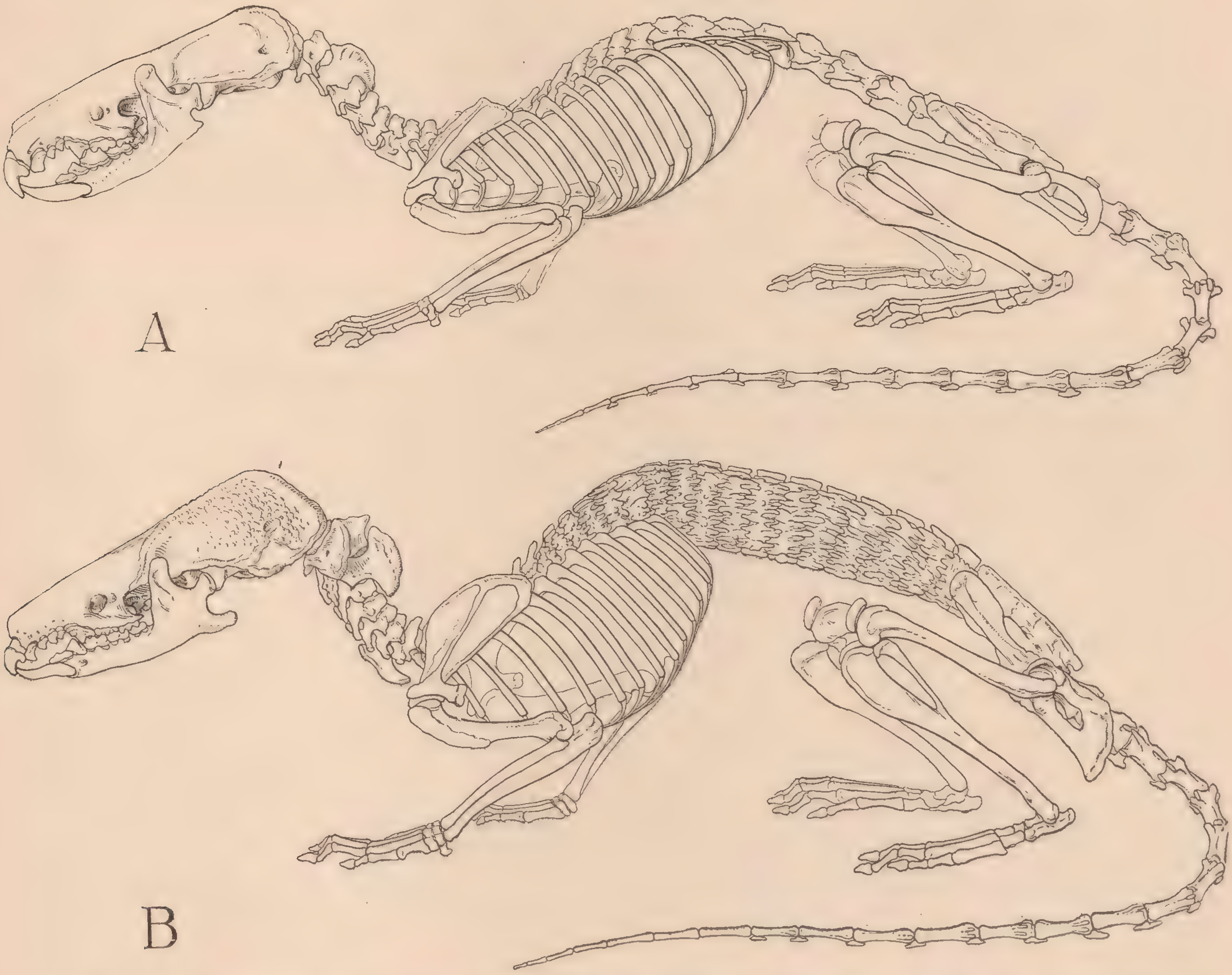


Fig. 8. Skeletons of (*A*) *Crocidura nyansæ kivu* and (*B*) *Scutisorex congicus*. Same specimens as Figs. 5–7. $\frac{1}{1}$.

The anterior articular facets are broadly expanded and cup-shaped, for the reception of the convex posterior articular facets of the preceding vertebra. The lateral edge of the anterior zygapophysis is vertically extended, its dorsal face expanded, forked in front and posteriorly prolonged into a long spine which interlocks with the fork on the front border of the anterior zygapophysis of the succeeding vertebra.

Rudimentary 'anapophyses' begin, as stated above, at about the 12th dorsal and become fully developed on the 1st lumbar, continuing thence posteriorly on each vertebra to the end of the lumbar series. They arise from the posterior half of the lamina midway between the neural spines and the posterior zygapophyses, and extend backward from the posterior third of the vertebra nearly to the base of the 'anapophysis' of the succeeding vertebra.

The ventral face of the anterior seven centra of the dorsals is convex and distinctly keeled, rather sharply so on the first three of the series, the keel flattening and the surface becoming more evenly convex posteriorly and quite flat on the last six; the last three have a low ridge, axially directed, on each side of the median line.

In the lumbar vertebræ the ventral face is transversely and deeply concave, the median third of each centrum flat or slightly concave, the lateral borders greatly thickened at base and narrowing apically to a high crest, the whole mass appearing on the outer surface as a complex of interlocking horizontal spines through excessive specialization, as shown in Figs. 4–7. Three horizontally directed spines arise from near the posterolateral border of each side of the centrum and overlap the frontolateral border of the next, upon which they are closely imbricated. They are apparently *sui generis*, without homologues. Functionally they appear to represent the anapophysis of the dorsal side of the neural arch of the same vertebræ, but instead of the single spine of the dorsal face, they form groups of two or three, and occasionally four.[1] The extreme crest of the lateral border, as seen from below, consists, for each vertebra, of a horizontal three-pointed spine, its anterior termination forming a single point, the posterior two nearly equal points, interlocking with the single point of the preceding vertebra.

The transverse processes of the dorsal and lumbar vertebræ are heavily developed and of normal form (nearly obsolete throughout both series in *Crocidura*) as far as the 7th dorsal; a change begins at the 8th dorsal, which, with the 9th, has the transverse process shortened and transversely thickened; the broadening is increased from the 10th dorsal thence to the posterior lumbar, gradually narrowing to about 5 mm. at the 11th (the last) lumbar. At the anterior end of this tract the spines are thickly massed without definite order, and their points are directed more or less outward. As the tract they occupy attains greater width they are arranged approximately in axial rows, varying in number at different points from five to seven. Those of each vertebra (as seen from the articular faces of disarticulated vertebræ) form two vertical rows of spines, an outer and an inner, which coalesce at the middle; those arising from the anterior border of the pedicle wall point forward, those on the posterior border backward; in this way the spines of each of two adjoining vertebræ so closely interlock that at the point of junction the spines conceal the less superficial portions of the vertebræ and also the vertebral articulations. (See Figs. 4–7.)

---

[1] The number is variable in different individuals, on different vertebræ of the same skeleton, and even on the two sides of the same vertebra, ranging in number from 1 to 4.

Sacral Vertebræ.— The spinous processes are fused as usual into a continuous lamina. The 'anapophyses' are rudimentary, and tend to form a slight low ridge at the base of the spinous process. In other respects they resemble the sacrals in *Crocidura.*

THE TAXONOMIC STATUS OF SCUTISOREX.

While the external and cranial characters of *Scutisorex* sufficiently indicate the propriety of its generic separation from *Crocidura* and *Sylvisorex*, the extreme specialization of the vertebral column, as shown above, should apparently be further emphasized, and it is here proposed to raise the *Scutisorex* group to the rank of a subfamily of the Soricidæ, under the name **Scutisoricinæ**.

FIELD NOTES ON SCUTISOREX.

The following field notes on *Scutisorex* are kindly furnished by Herbert Lang, leader of the American Museum of Natural History Congo Expedition, and furnish interesting proof of the great strength of the vertebral column.

"In the northern Ituri forest the 'hero shrew' (*Scutisorex congicus*) is the largest of the twelve species we found in this region. It can be easily recognized by its more clumsy appearance and its longer, denser pelage. Fully adult specimens measure 8.6 to 9.6 inches (218 mm. to 243 mm.) from nose to tip of tail, the latter accounting for about two-fifths of the total length. The largest individual recorded is a female.

"At present *Scutisorex congicus* is only known from two localities, Medje (2° 20′ N., 27° 30′ E.) and Bafwabaka (2° 3′ N., 27° 5′ E.), both situated near the borders of the tropical rain-forest and only about 30 miles distant one from the other. We never succeeded in securing specimens anywhere northward, though on inquiry we found, by the stories about the strength of its vertebral column, that the people as far as 100 miles northward knew the animal.

"The natives of these regions, especially the Mangbetu, who are well acquainted with this shrew, first called our attention to its abnormally strengthened back-bone by their performances upon captive specimens. These people feel convinced that its charred body or even its heart, when prepared by their medicine-men, transmit truly invincible qualities, if worn as a talisman or taken like a medicine. Perhaps this mystic reputation has often contributed to make of a brave man a real hero, wherefore the Mangbetu gave it a name meaning 'hero shrew.' Those engaging in warfare or setting out upon an equally dangerous enterprise such as hunting elephants are anxious to carry along even a fraction of the ashes of this shrew. Though only worn somewhere about their body, they believe that neither spears nor arrows, nor any kind of an attack can seriously injure them, much less bear them down. One can easily imagine that by the removal of the inhibitory influence of fear their courage, cunning and cleverness are set free for the best possible achievements.

"Whenever they have a chance they take great delight in showing to the easily fascinated crowd its extraordinary resistance to weight and pressure. After the usual hubbub of various invocations, a full-grown man weighing some 160 pounds steps barefooted upon the shrew. Steadily trying to balance himself upon one leg, he continues to vociferate several minutes. The poor creature seems certainly to be doomed. But as soon as his tormentor jumps off, the shrew after a few shivering movements tries to escape, none the worse for this mad experience and apparently in no need of the wild applause and exhortations of the throng.

"During this demonstration the head is always left free. The strength of the vertebral column, together with the strong convex curve behind the shoulder (Text Fig. 8, B), evidently protects the heart and other viscera from being crushed and this is undoubtedly the reason why this shrew can submit to such rough treatment that instantly kills, as we have convinced ourselves, any other shrew or small rodent."

"We found most stomachs to be empty, but a few contained portions of various adult insects, caterpillars and also earthworms; meat, skins and terminal phalanges of tiny frogs were recognized. This diet is practically the same as that of its closer relatives and contains only creatures easily killed by a shrew of its size and fairly abundant all over the floor of these tropical rain-forests. Its feeding-habits therefore offer no explanation of the usefulness or necessity of its enormously strengthened vertebral column.

In spite of the curious structural condition of its vertebral column, *Scutisorex congicus* can bend its back dorso-ventrally and laterally much more than any one would expect from the study of the skeletonized vertebral column that appears completely rigid. The much broadened, closely and laterally serrated articulations together with the interlocking action of the 'anapophyses' of course exclude rotation, but such a restriction is not apparent in the live specimen. In fact in their native haunts *Scutisorex congicus* and *Crocidura nyansæ kivu* in respect to the possibility of movements show hardly any differences for which the more sluggish temper of the former could not easily account.

"*Scutisorex congicus* is to a very great extent diurnal. Many specimens have been caught during the daytime, a few even at noon in bright sunlight when crossing pathways. Others have been trapped during the night, attracted by the bodies of winged termites that were used as bait.

"Being extremely shy it can seldom be discovered in its native haunts. Indeed the leafstrewn ground of the chaotic, luxuriant maze of the sombre undergrowth to such a small animal offers manifold and easy opportunities to elude an intruding observer. Captured specimens, set at liberty on the open ground, scurry along rapidly, usually making for the darkest spot in sight. Yet they go about in a more deliberate manner and do not rely upon the effectiveness of short and sudden dashes by which so many of the smaller mammals try to escape.

"One let loose in the early morning would busily lick off dewdrops from the margin of the leaves. But whenever it came to small tufts of grass, it would press down the blades with the fore limbs starting near the base until it could easily reach the glittering drops that had gathered at the tips.

"In watching them, it soon becomes clear that scent prevails over sight. The deeply grooved nose is moved in every direction, and continually quivering, it explores actively the objects in view. The under side of leaves and even stones are thus inspected. Fair-sized pebbles, pieces of bark and decayed wood are turned over or pulled away with the assistance of the incisors. When looking for insects or worms they squat resting the sole of the hind foot on the ground. Though their fatal, unyielding grab between the sharp row of teeth quickly finishes their prey, they never show the aggressive boldness of other related species. Neither are their attacks distinguished by the nervous display of rapid, jerking movements that help so many insectivores not only to overawe instantly their quarry but also to protect themselves from any possible defensive attack.

"Its more sluggish temper was especially apparent when in a cage together with other species of shrews. Though they might annoy it, it never killed any of them as *Crocidura nyansæ kivu* invariably did."— HERBERT LANG.

In the following paper (Art. XXIX) Dr. H. von W. Schulte considers the specialization of the dorso-lumbar series of vertebræ in *Scutisorex* from the morphogenetic side, and also the relation of the spicules to the enclosing ligamentous tissue based on studies made by him of a somewhat mutilated wet specimen. The skiagraphs (Plates LXXXIX and XC), giving comparative views of *Scutisorex congicus* and *Crocidura turba nilotica,* were taken for him during these investigations by Dr. Archibald Evans, of New York; for the opportunity to reproduce them here I am indebted to the greatly appreciated courtesy of Dr. Schulte.

The excellent text illustrations are mainly the work of Mr. Erwin S. Christman, under the superintendence of Mr. Herbert Lang in my behalf. Mr. Lang's work in the Belgian Congo made possible the preparation of this paper, and the following one by Dr. Schulte, on a unique and previously unknown specialization of the vertebral column in mammals.

The text illustrations and measurements of *Scutisorex congicus* are based on specimen No. 51311, an adult from Medje, except the figures of the separate vertebræ which are from No. 48452, a disarticulated vertebral column from a specimen taken at Bafwabaka. The skeleton of *Crocidura* used for comparison with *Scutisorex* is No. 48490, a male *C. nyanzæ kivu,* from Medje.

EXPLANATION OF PLATES.

Plate LXXXIX.

Skiagraphs of skeletons of (*A*) *Scutisorex congicus* (Thomas) (No. 48489, ♂, Medje, Aug. 13, 1910), and (*B*) *Crocidura turba nilotica* Heller (No. 48578, ♂, Faradje, Feb. 20, 1912). Dorsal views. $\frac{1}{1}$. Courtesy of Dr. H. von W. Schulte. $\frac{1}{1}$.

Plate XC.

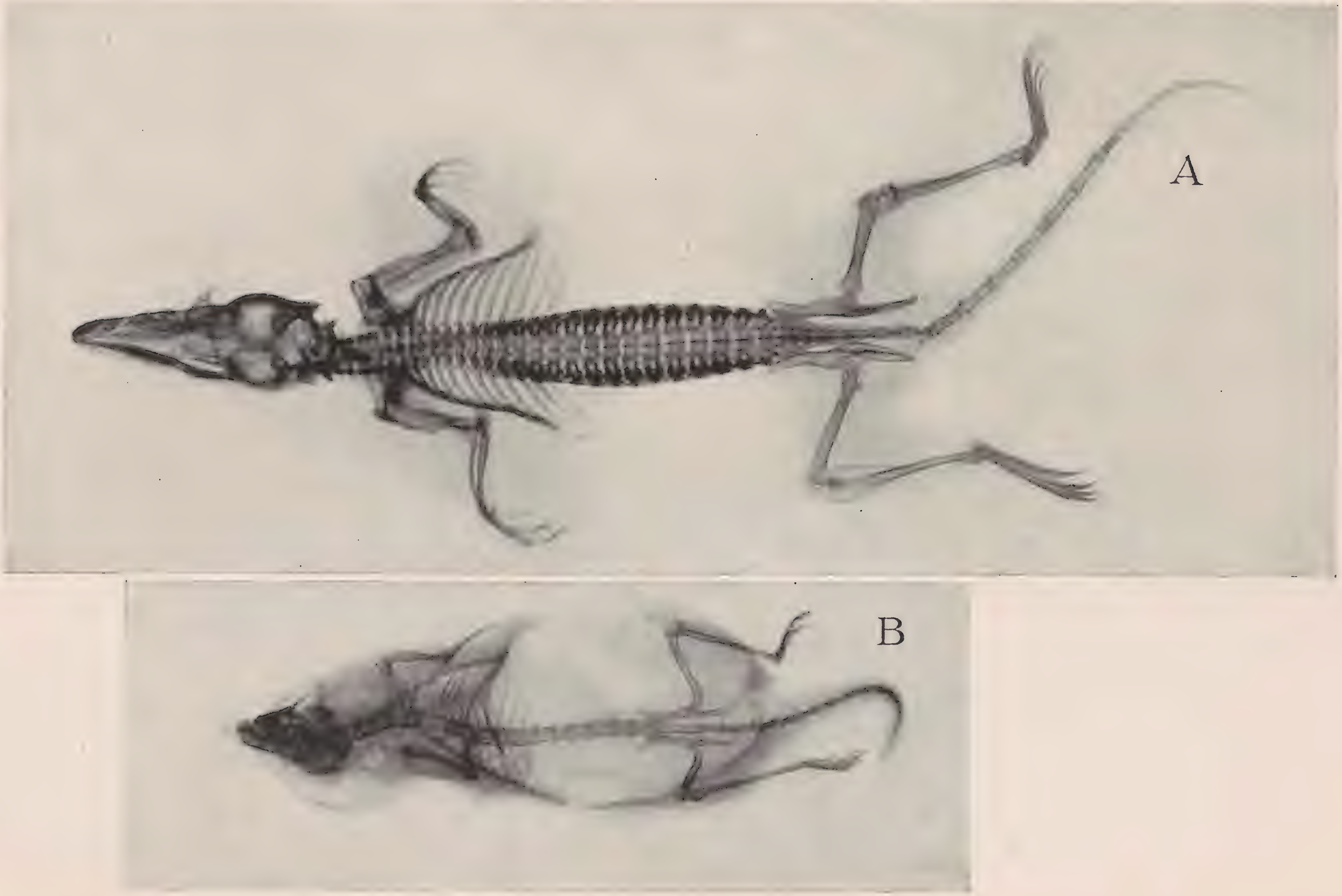
Skiagraphs of skeletons of (*A*) *Scutisorex congicus* and (*B*) *Crocidura turba nilotica.* Same specimens as in Plate LXXXIX. Lateral views. $\frac{1}{1}$. Courtesy of Dr. H. von W. Schulte.

Plate XCI.

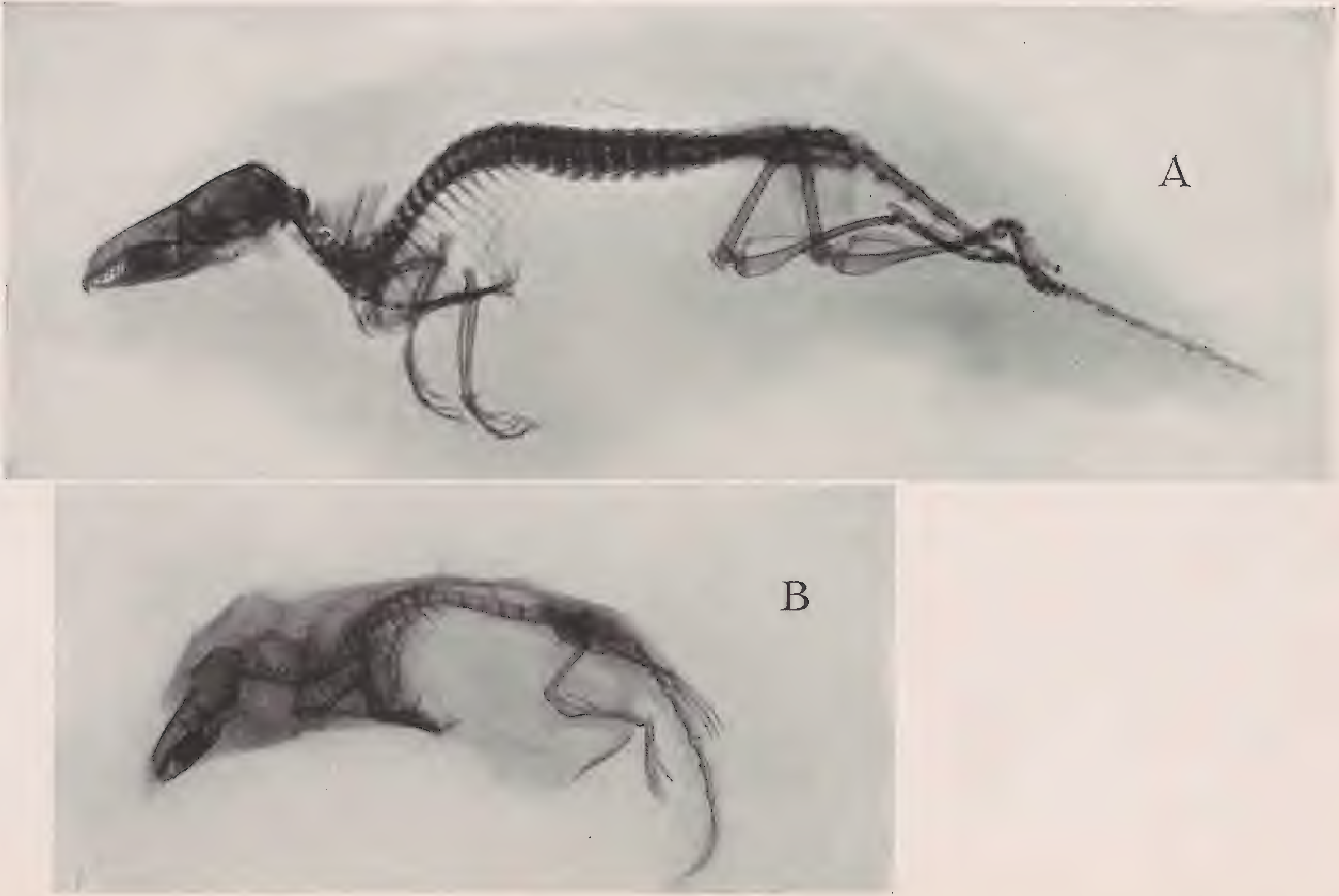
Scutisorex congicus (No. 48475, ♂, Medje, May 30, 1914), lateral view. $\frac{1}{1}$. From photograph of specimen in the flesh, by Herbert Lang.

Plate XCII.

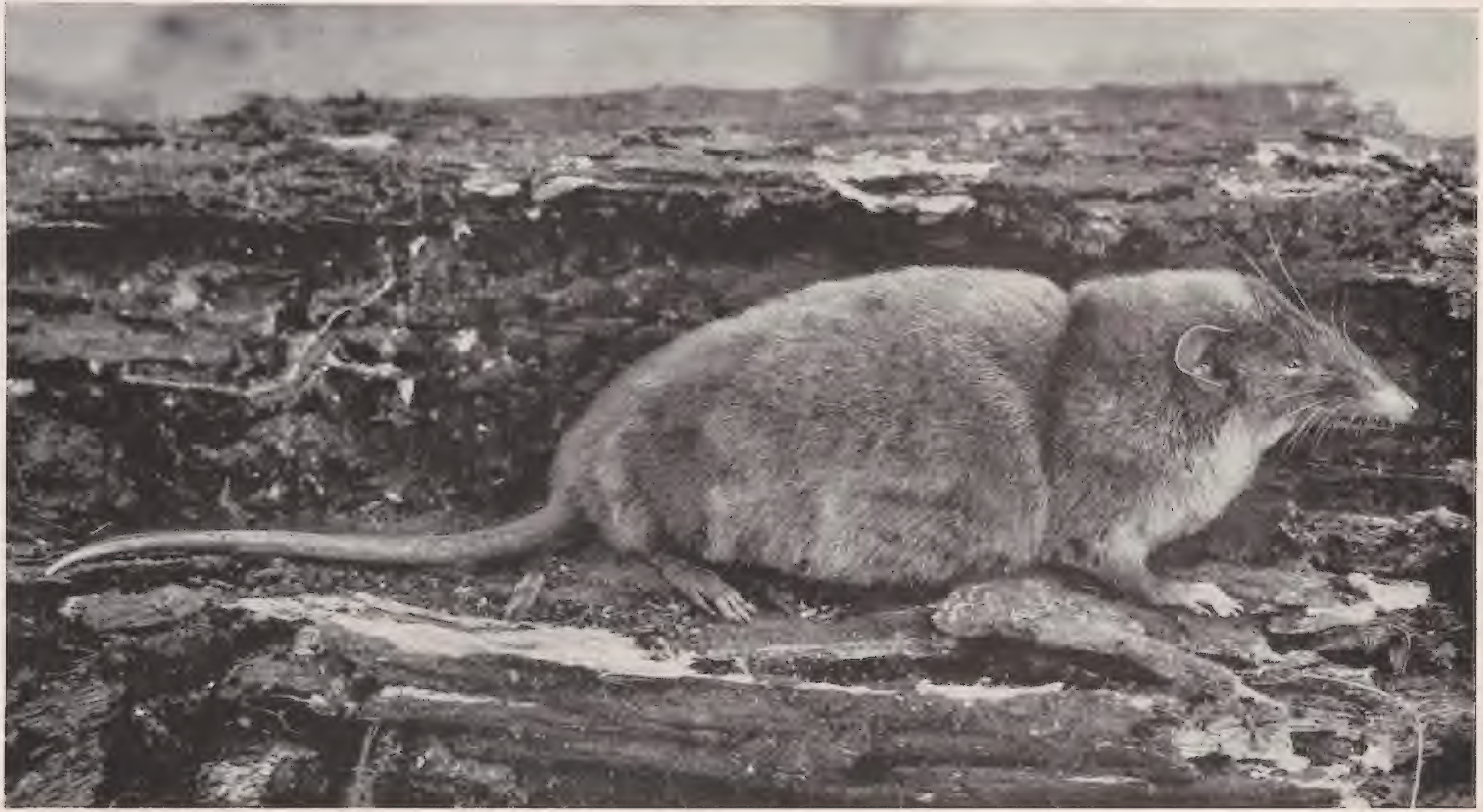
Crocidura nyansæ kivu (No. 48501, ♂, Medje, June 13, 1914), lateral view. $\frac{1}{1}$. From photograph of specimen in the flesh, by Herbert Lang.



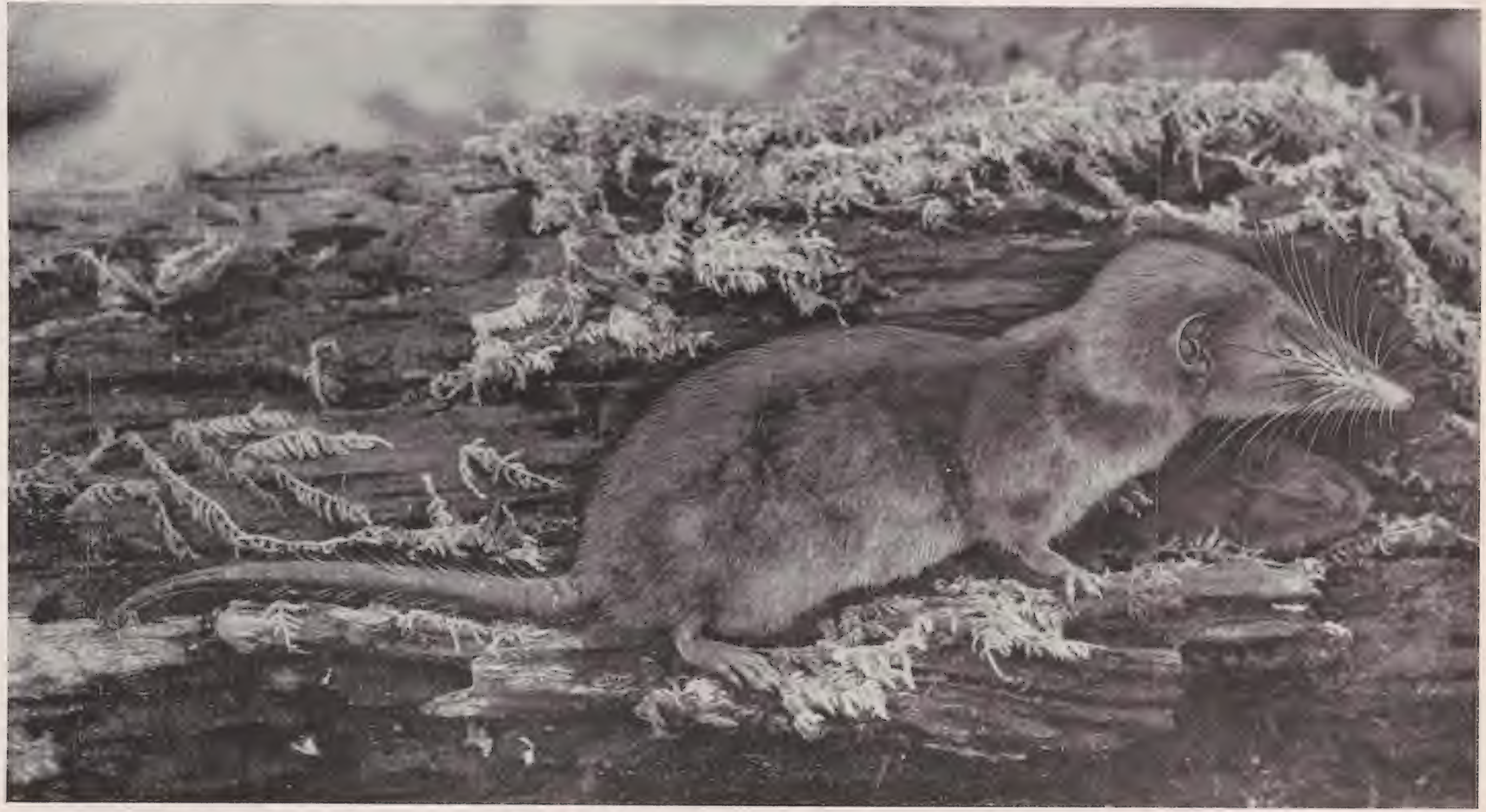
A, Scutisorex congicus; *B*, Crocidura turba nilotica. $\frac{1}{1}$.



A, Scutisorex congicus; *B*, Crocidura turba nilotica. $\frac{1}{1}$.



Scutisorex congicus. $\frac{1}{1}$.



CROCIDURA NYANSÆ KIVU. $\frac{1}{1}$.

59.9,33 S: 14.71,16

Article XXIX.— A NOTE ON THE LUMBAR VERTEBRÆ OF *SCUTISOREX* THOMAS.[1]

By H. von W. Schulte.

The spine of *Scutisorex* is remarkable among insectivores for the extreme lengthening of its lumbar segment and perhaps unique among mammals for the peculiar modification of these vertebræ which are transformed at the sides into a series of tooth-like processes closely interlocking, but never synostosed, with those of adjacent vertebræ. The characters of these vertebræ have been described in detail by Dr. J. A. Allen,[2] and the reader is referred to his text and excellent illustrations for anatomical information which falls outside the scope of this note. It is a pleasure to express my obligations to Dr. Allen who has very kindly permitted me to make use of his paper while still in manuscript.

While these modifications are characteristic of the lumbar spine and attain their maximum at the midlumbar vertebra, the sixth, they are not limited to this region but encroach upon the thorax where their prodromata can be recognized as far rostrad as the sixth or fifth vertebra. This limit corresponds to the summit of the thoracic kyphosis which is conspicuous in this genus as in other insectivores, and depends, as is usual, on the shape of the intervertebral disks rather than upon that of the centra which are, if anything, rather thicker ventrad than dorsad in the thorax. The result is that the lower thoracic and lumbar vertebræ are coapted into a rigid arch which is qualified to supply a firm support to the more flexible upper thoracic and cervical regions. That this pronounced hump of the dorsal region is not due to distortion and is not confined to *Scutisorex* is shown in the accompanying skiagraphs (Plates LXXXIX and XC) where it is seen to be as pronounced in the *Crocidura* which was preserved intact and in normal position as in the wet specimen of *Scutisorex*. Such a mechanism might conceivably subserve the well-being of the beast in one of two ways: either in giving a fulcrum for rather free and forcible movements of the head, and that such occur may be surmised from the high spine of the second and the long one of the last cervical vertebra (Allen, fig. 7); or by affording protection against crushing of the trunk by a force acting from above, which the animal is known to be able to sustain without injury to a highly remarkable degree. Mr. Herbert Lang states that natives exhibit this peculiarity of the animal by standing upon it, and has seen it run off apparently none the worse for thus sustaining the weight of a man. It is important to note, however, that the same observer was unable to find in the natural environment or habits of this shrew anything that throws light upon the extraordinary development of its spinal column.

---

[1] Scientific Results of the American Museum of Natural History Congo Expedition. Mammalogy, No. 4.

[2] Allen, J. A. The skeletal characters of *Scutisorex* Thomas. Bull. Amer. Mus. Nat. Hist. XXXVII, pp. 769–783, pls. LXXXIX–XCII, 1917. The citations of figures in my text refer to this paper.

From these preliminary considerations we may turn to the mechanism involved, and here the character of the articulations especially between the zygapophyses demands attention. These are modified in the lumbar region in a manner to preclude rotation and seemingly also lateral bending while permitting flexion and extension. The postzygapophyses are flatly convex from side to side and look ventrad and but slightly mesad. They are received in depressions bordered by well developed lips and it is these lips which interfere with the transverse gliding of the surfaces incident to rotation. In the lower thorax the lips subside but it is precisely here that another contrivance limiting rotation comes into play (Allen, figs. 4 and 5). The spines of the last three thoracic vertebræ are bifid, and each receives the spine of the next following vertebra between its points. The spine of the ninth is similarly modified but is too short to reach that of the tenth, and here rotation in the dried skeleton first becomes possible while it is excluded between the tenth and eleventh thoracic vertebræ and thence caudad. In connection with these bifid spines it is interesting to note a row of small spicular processes of the neural arch immediately mesial to the postzygapophyses in the caudal portion of the lumbar series, which rostrad converge and approach the spines. It is their union with those processes which in the lower thorax gives these elements their bifid character.[1]

A provision against extension, not otherwise limited, exists in the spines of the lumbar vertebræ. These are subrectangular, of moderate elevation attaining a maximum at the middle of the series, and so expanded sagitally that they are all but in contact, and actually so when the vertebræ are bent dorsad thus affording a bony obstacle to movement in this direction (Allen, fig. 7).

Thus the lumbar spine is deprived of mobility in the sense of extension and rotation by slight modifications of its normal processes. It remains to consider the highly peculiar changes that have affected the lateral regions of the vertebræ. These are initiated in the middle of the thorax by the appearance of conical tubercles on the margins of the transverse processes. The sixth vertebra has them only on its caudal margin, from the seventh caudad they beset both margins of the transverse process and increase rapidly in number and extent, reaching ventrad continuously as far as the facette for the capitulum of the rib and when this makes defect taking its place and encroaching though only to a slight degree upon the centra. These last in general bear but one short spicule on each side at the junction with the pedicle and even this is lacking upon the last three lumbar vertebræ which, however, are marked by a faint median ridge; on the other hand, the involvement is at its maximum in the 2d–5th lumbar, where the fronts of the centra are tuberculate and their margins crenulated. Further the mass of spicules projects ventrad in the lumbar series, most markedly at its middle so that this region of the vertebral column is transformed into an osseous gutter open ventrad (Allen, figs. 4–7).

---

[1] In these provisions for limiting rotation the spine of *Scutisorex* differs from that of *Crocidura* which has the usual simple zygapophyses and spinous processes.

A consequence of the modification of the side of the vertebræ is a displacement of the intervertebral foramina, which are displaced ventrad and dorsad and appear somewhat as do the sacral foramina. The ventral ones are formed largely at the expense of the rostral vertebra of each pair and are situated between the spicule arising from the body and the lateral mass of each vertebra. To these orifices a faint furrow may be followed from the vertebral canal on the caudal surface of each vertebra. These foramina may become reduced in size by coalescence of their bounding spicules; this is the case of those of the sixth, seventh and eighth pairs in the spine I have examined. In these the foramen is included wholly in the more rostral vertebra and is so minute that a reduction in size of the ventral division of the corresponding nerve must be inferred. The dorsal foramina are represented by small orifices lateral to the postzygapophyses, between them and the most mesial spicule of the lateral mass. They likewise are continued to the vertebral canal by shallow grooves on the caudal surfaces of the vertebræ.

The lateral mass of each vertebra consists of a plate of dorsoventral orientation, thickly and irregularly beset on both its rostral and caudal surfaces with slender conical processes or spicules of bone. These consist of a row at the periphery and in the vertebræ of largest size a second row smaller, often mere tubercles, between them and the vertebral canal (Allen, figs. 4–7). Those on the caudal surface are in general slightly larger. This disproportion permits of slight movement, flexion or lateral bending, between adjacent vertebræ notwithstanding the intimate interlocking of the spicules of successive vertebræ.

The question then arises, what elements of the vertebræ are involved in this spicular transformation? The condition of the lower thoracic vertebræ makes it clear that the transverse processes and pedicles are, but the great increase of the mass in the lumbar region requires additional explanation. It will be remembered that the capitular facette in the thorax forms the mesial limit of the change. Further caudad the spicules occupy this region also. It would seem therefore that the ankylosed costal element in the lumbar region becomes transformed into spicules. This deduction is strengthened by the position of the nervous foramina and by the contours of the rostral and caudal surfaces of the bones which are curiously like sacral vertebræ. Not only has the costo-transverse space been filled up as usual, but the costal process has expanded laterad and ventrad quite apart from its secondary equipment with spicules. The ventral tips of these modified ribs form the edges of the gutter which characterizes this portion of the spine.

These lumbar vertebræ have therefore undergone a change in general form such as is usual only in the sacral segment. To this as a mere formal statement of the approximation in shape of the lumbar costal element to that of the sacral series there can be no serious objection; but are we warranted in taking these vertebræ to be examples of actual sacralization? In other words, can the form of the costal element, abstraction made of its spicules, be accounted for together with the lengthening of the lumbar series numerically by a backward shift of the pelvis *en masse* along the spine? Some support may be gained for such an assumption in the variations within a species of the level of the first sacral vertebra. In man, for example, the first sacral may be the 24th or the 26th instead of as is usual the 25th of the series. Further, transitional vertebræ having the character of a sacral on one side, of a lumbar on the other, are among the not infrequent variations of the human spine. By way of historical explanation it has been shown that there is a numerical shortening of the spine among primates with the assumption of the upright position, a shortening which from a mechanical standpoint is obviously advantageous. For a time it was believed that this abbreviation of the spinal column was recapitulated in the development of the individual by a movement forward of the sacrum along the spine after the skeletal elements involved had been laid down in the membrane.[1] But this has been found erroneous by subsequent observers [2] and there are no grounds for holding that the number of presacral vertebræ are diminished during development. We can therefore accept

---

[1] Rosenberg, E. Ueber die Entwickelung der Wirbelsäule und das Centrale carpi des Menschen. Morph. Jahrb., Bd. I, 1876.

[2] Holl, M. Ueber die richtige Deutung der Querfortsätze der Lendenwirbel und die Entwickelung der Wirbelsäule des Menschen. Sitzungsb. d. K. Akad. d. Wiss. Math.-Naturwiss. Klass. Wien, Bd. 85, 1882. Paterson, A. M. The human sacrum. Sci. Trans. Royal Soc. Dublin, Vol. 5, 1893. Bardeen, C. R. Studies of the development of the human skeleton. Am. Jour. Anat., Vol. 4, 1905.

a shift of the pelvis only in a phyletic sense as revealed by discrepancies in the number of dorso-lumbar vertebræ among related species. Such differences are pronounced in the dorso-lumbar vertebræ of insectivores, their number ranging from 13 in *Myogale* and *Talpa* (Flower) to 21 in *Crocidura* (Allen), so that the first lumbar vertebra varies from the 21st of the total series in the former to the 29th in the latter. *Scutisorex* represents the upper limit of variation in this respect, having 14 thoracic and 11 lumbar vertebræ (Allen); the first sacral is accordingly the 33d of the vertebral series. This numerical lengthening of the presacral spine can hardly be accounted for otherwise than by a caudal shifting of the pelvis in the evolution of the long spined genera. But this granted, there is no evidence that such additional lumbar vertebræ ever retain any trace of their previous sacralization and even were the possibility admitted for purposes of argument, the assumption would explain too much in the case under consideration for the whole lumbar segment is similarly modified.

If then we cannot associate the unusual form of the costal element of the lumbar vertebræ with an ancestral more advanced position of the pelvis, we are in no better case if we attempt to explain this peculiarity as anticipatory of a forward shifting of the pelvis and for the same reasons. The relation of pelvis to spine is definitive from its first appearance in the embryo and the number of vertebræ involved is far in excess of any possible advance of the pelvis.

As there is no known developmental process, to excess or deficiency in which variation in the position of the pelvis may be attributed, we arrive at the conclusion that germinal factors are the presumptive cause of differences in the number of presacral vertebræ, whether in this case of *Scutisorex* a single mutation be operative or a series alike in direction, constituting an orthogenetic process and affecting at the same time the number of presacral vertebræ and the form of the costal elements in the lumbar segment.

In *Scutisorex* the widest lumbar vertebra is the 6th, that is, the 28th of the total series (Allen, figs. 4 and 5). If, on account of its breadth, it be taken as representing what was formerly the first sacral, it would follow that the shifting of the pelvis over five vertebræ to the 33d had taken place in a single mutation, for otherwise on the foregoing assumption its successive positions would each have obliterated the traces of its preceding one. What little plausibility there may be in such a line of reasoning is enhanced rather than diminished by the fact that the nearby related *Crocidura* has two species in which there are 27 presacral vertebræ, and the first sacral therefore corresponds numerically to the broad lumbar of *Scutisorex*, the 28th of the vertebral series. But great reserve is necessary in view of the plasticity of bone under the mechanical factors of stress and the broadening of this vertebra in *Scutisorex* may be due to its position in the dorso-lumbar arch.

The difficulty we feel in the presence of such extreme modifications as this lumbar lengthening and spicular formation, is the absence of intermediate forms to connect them with usual conditions obtaining within the order. In a species not otherwise aberrant one or two salient peculiarities are encountered, which in a single organ or system remove it widely from its nearest congeners. Analogous cases are afforded by the stomach of *Semnopithecus,* the tracheal bulla of *Taxidea,*[1] the peculiarly curved trachea of *Bradypus*[2] and the spermaceti-organ of the Physeterinæ. The lack of knowledge of intermediate related forms deprives us of a basis for classifying them as examples of orthogenesis or as the cumulative result of selection of fluctuating variations; and the absence of analogous modifications in members of other orders of similar habitus gives little ground for designating them as adaptations.

Here it may be well to point out that these interlocking spicules are in no way comparable to the accessory articulations of *Xenarthra,* primarily because they are not articular: they are not covered with cartilage but are embedded in the ligamentous tissue which surrounds the spine, as could be ascertained from the wet specimen available for study. That the spicules are the result of ossification in this tissue or in attached tendons is an assumption hard to avoid. They are present largely but not exclusively in the domain of the ilio-costalis. Very unfortunately this muscle was damaged in skinning the animal and thereafter desiccated almost beyond recovery. I do not think, however, that I am mistaken in believing that I traced several of its tendons to the tips of spicules. The ventral gutter of the lumbar region was largely and towards the pelvis completely filled with muscle, the psoas minor, psoas major and quadratus lumborum being all of them well developed and arising by numerous slips from the ventral tip and mesal surface of the costal elements. The plane of the psoas parvus was prolonged rostrad to the diaphragm by a series of muscular slips which arose from the centra at and about their single spicule on each side and coursed obliquely ventrad and caudad to the tip of the costal process of a more caudal vertebra. The groove on each side dorsally between the transverse process and spine was occupied by a feebly developed sacrospinalis, its feebleness bearing out the inference of loss of extension in this segment.

---

[1] Huntington, G. S. The eparterial bronchial system of the Mammalia. Annals New York Acad. Sci., Vol. 11, 1898.

[2] Specimen in the Department of Anatomy, Columbia University.

There is then some evidence for the associations of spicule formation with ossification at points of tendon insertion and perhaps of tendons themselves, but there is no marked peculiarity of the musculature[1] ascertainable to explain why it occurs in precisely this genus and no other. Whether the underlying process is biologically allied to changes which in man are referable to disease is perhaps worthy of discussion in view of Larger's[2] recently published theories on this subject. In general the spicules are clean cut and have little but their irregularity to suggest disease. Here and there, however, they are thickened or even fused together — this applies only to adjacent spicules of the same vertebra, there is no synostosis between vertebræ — and in a very few places small bony nodules are present. Elsewhere the skeleton is hardly open to the suspicion of degeneration save perhaps in the rugose surface of the parietals and a small and doubtful calcification of the ligamentum nuchæ which did not show in the skiagraph. The spicules do not closely resemble either in situation or appearance the ossified muscles of dinosaurs described by Dollo[3] and interpreted as evidences of racial degeneration by Larger. Further the spicules of an immature skeleton are not materially different from those of the larger adults and an abnormal process of this sort might perhaps be expected to become more pronounced with age.

Morphologically therefore we must conclude that the peculiarities of the lumbar vertebræ of *Scutisorex* consist in the unusual size of the costal elements and the production from their surfaces and from the amalgamated transverse processes of osseous spicules at the sites of muscular insertions and origins, a process possibly predisposed to by the relative immobility of the spine occasioned by the character of its zygapophyses and spinous processes, and resulting in an arch of great strength able to resist pressure from above and to afford support to vigorous movements of the head and forelimbs. It is not evident that these modifications are useful, but is it not necessary to assume that mutations are always favorable, nor that a useless or even slightly detrimental structure must at once disappear or entail the extinction of the species, for another factor comes into play, the severity of the struggle for existence. While the general process of evolution secures a harmony between organism and environment, luck or cunning may afford a respite to impending fate for a time or in a minority of instances.

---

[1] Leche, W. Zur Anatomie der Beckenregion bei Insectivora, mit besonderer Berücksichtigung ihrer morphologischen Beziehungen zu diejenigen anderer Säugethiere. Kongl. Svenska Vetenskaps-Akad. Handl., B. 20, No. 4, Stockholm, 1883.

[2] Larger, R. Théorie de la contre-évolution ou dégénérescence par l'hérédité pathologique. Paris. 1917.

[3] Dollo, L. Note sur les ligaments ossifiés des dinosauriens de Bernissart. Arch. de Biol., T. 7, 1887.

While it seems necessary to ascribe the lengthening of the lumbar spine of *Scutisorex* to mutation, it is not certain that the spicular processes of the vertebræ are so immediately dependent upon changes in the germ-plasm. The extreme plasticity of bone and its sensitiveness to changes in the internal medium as well as to mechanical forces dispose one to see in the osseous system the summation of many factors. Like the blood vessels, determined by mechanical laws, and presenting in their changing patterns an integration of the relative rates of growth of all the parts of the developing organism, so the skeleton in the detailed conformation of its many parts is the resultant of many chemical and physical factors and through their determinants rather than independently may be represented in the chromosomes. In this connection much interest attaches to Larger's insistence upon the resemblances of certain skeletal types among existing and extinct animals to conditions of the human skeleton associated with abnormalities of the ductless glands. It seems not too much to hope that these and other chemical alterations of the internal medium may throw light upon modifications of the bony structures at present inexplicable or referred solely to mechanical causes.

59.76(8)

Article XXX.—THE SYSTEMATIC STATUS OF SOME BATRACHIANS FROM SOUTH AMERICA.

By G. K. Noble.

Plates XCIII–XCVI.

CONTENTS.

PAGE.

1. The status of *Eleutherodactylus lineatus* (Schneider) and *E. miliaris* (Spix) 793
2. A new species of *Cerathyla* from Colombia, with remarks upon the genus . 797
3. The status of *Hyla fuhrmanni* Peracca, with remarks upon the homology of its larval structures 803

Literature cited 813

Introduction.

The American Museum has received during the past five years a number of valuable collections of Reptiles and Amphibians from South America. Before attempting a complete report upon any one collection, it has been thought advisable to clear up some of the more important problems connected with this material. In batrachian classification the form of the terminal phalanx has been considered of great importance in some of the groups. It is the purpose of this paper to discuss several groups of South American batrachians represented in the collections and to point out the value of phalanx form in these groups. A correlation of the larval histories of some of the genera has been made from a phylogenetic point of view in order to shed light upon our main problem.

I take pleasure in thanking Dr. Leonhard Stejneger for giving me a part of the type specimen of *Cerathyla panamensis* for histological study. To Dr. Thomas Barbour and to Dr. A. G. Ruthven I am indebted for the privilege of examining specimens of *Eleutherodactylus lineatus* in the collections of the institutions with which they are associated.

1. The Status of Eleutherodactylus lineatus (Schneider) and Eleutherodactylus miliaris (Spix).

Eleutherodactylus lineatus has been placed in many different genera in the past. After it had been allied first with the genus *Rana* and then with *Bufo*, Duméril and Bibron (1841, p. 625) pointed out its relationship to the genus *Hylodes*. Fitzinger (1843, p. 31) subdivided *Hylodes* and made *lineatus* the type of a new genus, *Lithodytes;* but he did not define this genus. Cope (1862, p. 153) followed Fitzinger and later described some new species of the genus *Lithodytes*. Boulenger (1882, p. 207) followed Guenther (1858, p. 91) in accepting the arrangement of Duméril and Bibron. It was not until many years later that Peracca (1904, p. 31) dissected a specimen of *lineatus* and noted its *Leptodactylus*-like pectoral girdle. He pointed out the distinctness of *lineatus* from any *Hylodes* and set up again Fitzinger's *Lithodytes* which Boulenger had considered synonymous with *Hylodes*. Peracca defined *Lithodytes* and made it a monotypic genus transitional between *Hylodes* and *Leptodactylus*. Recently Despax (1911a, p. 40) has disregarded the careful work of Peracca and has referred *lineatus* back again to the genus *Hylodes*. *Eleutherodactylus* is an earlier name for *Hylodes* (see Stejneger, 1902, p. 582).

In a collection of amphibians from British Guiana given to the American Museum by Mr. C. W. Beebe there is a single adult specimen of *Eleutherodactylus lineatus*. The Museum of Comparative Zoölogy has kindly placed at my disposal three smaller specimens of the species. One of these specimens (M. C. Z. 2962) was collected by Rosenberg and was identified by Boulenger as *E. lineatus*. Dr. Ruthven, of the University of Michigan, although engaged himself in a study of the species, has kindly lent me another young specimen. These five specimens form the basis of my work upon the species. The difference in size of the specimens is given below. The measurements are from snout to vent.

1.	Beebe Collection at A. M. N. H. British Guiana, Tropical Research Station	45.5mm.
2.	M. C. Z. 2962. British Guiana	34.5 “
3.	Ruthven Collection at Univ. of Mich. British Guiana, Demerara River	29.0 “
4.	M. C. Z. 2558. British Guiana, Aremu River	28.5 “
5.	Wyman Collection at M. C. Z. Dutch Guiana	22.5 “

The only character given by Peracca (1904, p. 31) to distinguish *Lithodytes* from *Leptodactylus* is the presence of T-shaped terminal phalanges in the former genus. The pectoral girdle is typical of the genus *Leptodactylus*. Most of the external features of *Lithodytes* are *Leptodactylus*-like, but its coloration is very peculiar. The color pattern is similar to the two-striped variation of *Dendrobates trivittatus* or the typical color form of *Dendrobates braccatus*. Dr. Ruthven informs me that the specimen he secured was very rapid in its movements, which resembled those of a *Dendrobates* more than those of a *Leptodactylus*. But these differences are only of specific value. The generic status of *lineatus* is dependent upon the exact form of its terminal phalanges.

A study of all of the terminal phalanges of the five specimens of *E. lineatus* has led to the following conclusions:

1. The five specimens may be taken as representing four successive stages in the ontogeny of an individual.
2. In this ontogeny the terminal phalanges change from an *Eleutherodactylus*-like, T-shaped type to a *Leptodactylus*-like simple type.
3. The change is brought about by an increase in the length of the phalanges and by a reduction in the extent of the terminal crossbars.
4. This change in form of the terminal phalanges is correlated with a change in form of the digital expansions from a somewhat modified but distinct *Eleutherodactylus* type to a *Leptodactylus* type.
5. The simple phalanges occurring in the adult must be considered typical for the species.
6. The species must be referred to the genus *Leptodactylus*.

In order to study the phalanges of the specimens the tips of the digits were dipped in a solution of glycerin and hydrogen peroxide. They were then dehydrated, and cleared in cedar oil. Subsequent washing in 70% alcohol restored the specimens to nearly their normal condition. The range of variation between the phalanges in young and adult specimens is shown in Fig. 1. For the sake of comparison I have included a figure of a terminal phalanx in a true *Eleutherodactylus,* and two other figures which show the normal range of variation in the ontogeny of *Leptodactylus melanotus,* which is perhaps closely allied to the species under discussion.

An appreciation of the ontogeny in the terminal phalanges of *Leptodactylus lineatus* allows one to interpret the status of *Eleutherodactylus miliaris.* Boulenger (1891, p. 454) removed this species from Cope's genus *Thoropa* and referred it to *Borborocœtes.* Wandolleck (1907, p. 5) shifted it to the genus *Eleutherodactylus* because he found that the terminal phalanges were T-shaped. I have examined an adult male specimen in the collection of the American Museum. The terminal phalanges are only moderately dilated, similar to those of the young *L. melanotus* (Fig. 1, D). The specimen of *Eleutherodactylus miliaris* which Wandolleck figured was not adult. It seems to me very probable that a change of phalange form takes place as in *L. lineatus* during the life of an individual. As in that species, the simpler type of terminal phalange occurs in the adult. There is no good reason for removing the species from the genus *Borborocœtes* where Boulenger placed it.

It is generally accepted that in some genera the form of the terminal phalanges is of little diagnostic importance. In *Rana* the terminal phalanges may be pointed or T-shaped. Barbour (1909, Pl. 18) has shown the great range of variation of the terminal phalanges within the genus *Kaloula.*

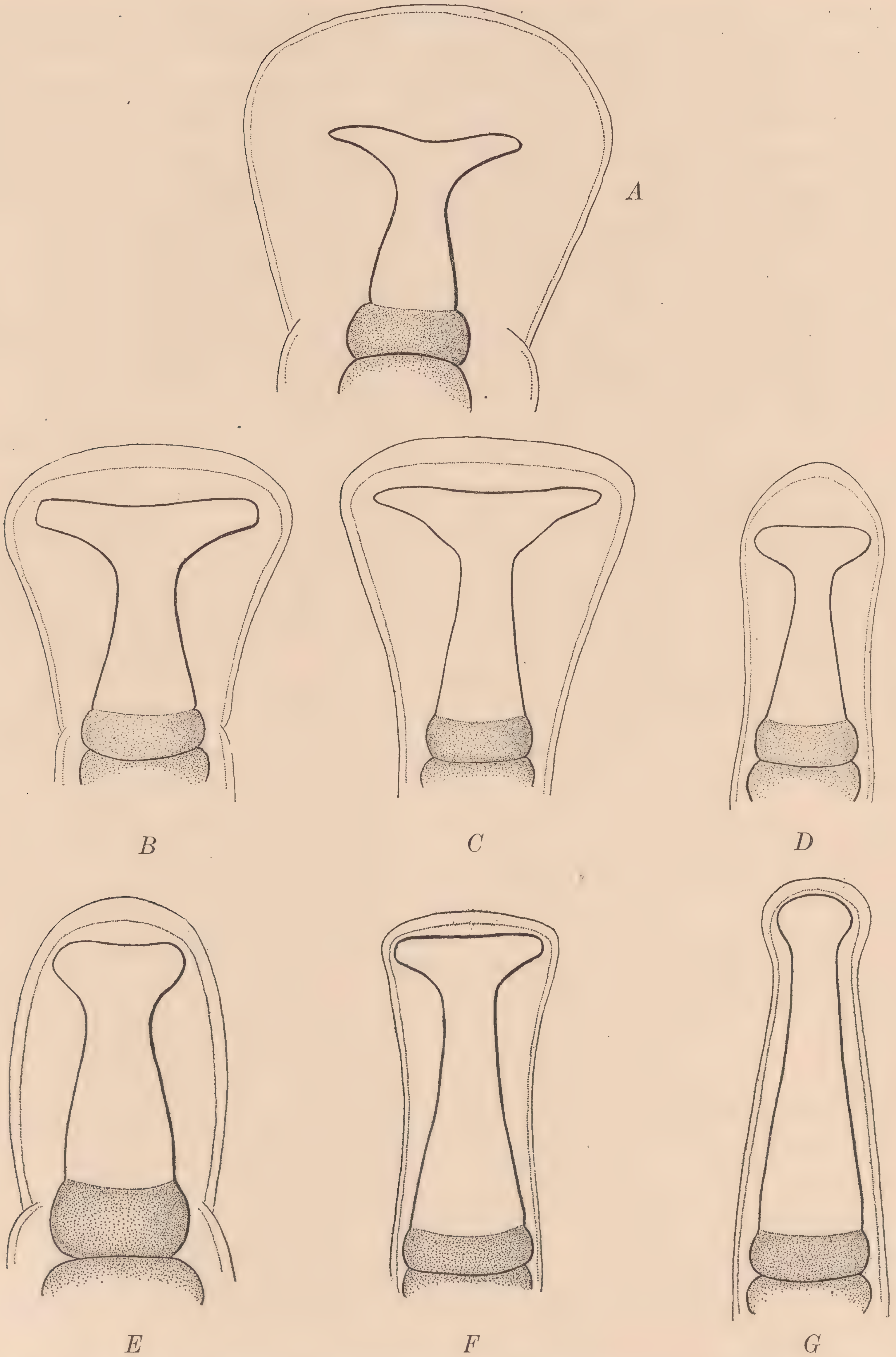


Fig. 1. Ontogeny of terminal phalanges from an *Eleutherodactylus* to a *Leptodactylus* type.

A, ADULT, second finger, left manus, *Leptodactylus lineatus*. *B*, *C*, *D*, IMMATURE: — *B*, second finger, right manus, *Leptodactylus lineatus;* *C*, third toe, left pes, *Leptodactylus lineatus;* *D*, third toe, left pes, *L. melanotus*. *E*, *F*, *G*, ADULT:— *E*, third finger, right manus, *L. lineatus;* *F*, third toe, left pes, *L. lineatus;* *G*, third toe, left pes, *L. melanctus*.

It is now probable that the variation of the terminal phalanges is not only due to a difference of species but also to a difference of age of the specimens. Whether the T-shaped terminal phalanges are in all cases more primitive than simple ones is not known, but in *L. lineatus* the simple ones occur only in the adult stage. Moreover, since *Leptodactylus* with its simple phalanges is structurally a more advanced type of batrachian than *Eleutherodactylus* with its T-shaped ones, it is probable that simple phalanges were acquired more recently than T-shaped ones. It is possible, however, that the shape of the terminal phalanges is correlated with the shape of the digital expansion and these in turn with the nature of the environment. Claw-shaped phalanges of the Hylids show little variation. Just how they developed is not known.

It is probable that claw-shaped phalanges are but slightly modified simple ones. There are many species with curved, T-shaped and others with curved, simple phalanges. The most specialized Leptodactylids have not the T-shaped terminal phalanges of the less modified forms but they have simple phalanges. We should expect in over-specialized batrachians of the Leptodactylid stock that their terminal phalanges would be the next degree further along in our scheme of specialization,— or claw-shaped phalanges. That is exactly what we do find in the two specialized genera to be discussed in the following pages.

2. A NEW SPECIES OF CERATHYLA FROM COLOMBIA, WITH REMARKS UPON THE GENUS.

The well preserved collection of Amphibians given to the American Museum by Mr. R. D. O. Johnson contains three specimens of a new species of *Cerathyla* from Colombia. Stejneger (1917, p. 31) has said of this genus: "It is not only one of the rarest genera in collections but its aspect is also very singular, due to the large triangular head with its bony casque posteriorly extended as two pointed horns, and the dermal flaps on snout and eyelids."

The occurrence of a *Cerathyla* in Colombia adds a new genus to the batrachian fauna of that country, and it bridges over a gap in the distribution of the genus. It gives *Cerathyla* a continuous range from Panama to Peru. Boulenger (1903, p. 115) in discussing *Cerathyla bubalus* says that it is "an inhabitant of the Andes of Ecuador, Bolivia, and Peru." *Cerathyla* probably occurs in Bolivia but no specimens have been recorded from there.

Cerathyla johnsoni[1] sp. nov.

Plate XCIII.

Diagnosis:— Dorsal surface distinctly granular; upper eyelid covered with tubercles, one of which on the edge of the eyelid near its mid point is larger than the others; third and fifth toes webbed to the penultimate phalanges; tibio-tarsal articulation reaching between the eye and tip of snout. Distance between the anterior angles of the eyes slightly more than twice as long as the greatest diameter of either eye; interorbital width a little more than twice the distance between the nostrils; distance between nostrils just equal to the distance from the tip of snout, slightly more than half the distance to the orbit. Color above dark reddish brown; sides of body ashy reticulated with pale straw color.

Habitat.— Department of Antioquia, Colombia, S. A.

Type.— No. 1341 A. M. N. H. "Limited area in the precipitous valley of the Santa Rita Creek which is located 14 miles north of the little village of Mesopotamia in the southeastern part of the Department of Antioquia, Republic of Colombia, S. A."; R. D. O. Johnson, collector.

Description of type specimen.— (Adult female with gonads well developed.) — Tongue longer than broad; palatine teeth in two slightly oblique series, well separated from each other in the middle but extending on the sides to the maxillary bones; vomerine series V-shaped, the point directed posteriorly; the extreme anterior vomerine teeth on each side longer than the others; snout with a short, compressed, pointed dermal flap; upper eyelid covered with tubercles, one of which on the edge of the eyelid near its mid point is larger than the others but not much larger than one above the posterior angle of the eye. Distance between nostrils just equal to their distance from tip of snout, slightly more than half the distance from orbit; width of upper eyelid nearly equal to the distance of nostrils from tip of snout; interorbital space one and one half times the width of the upper eyelid, a little more than twice the distance between nostrils; interorbital space slightly concave with distinct ridges; distance between points of the occipital horns a little more than the distance from either point to the nostril on the same side, equal to three times the interorbital width; posterior outline of the casque forming an open V but not a semicircle; tympanum turned nearly backward, its greatest diameter almost equal to the diameter of the orbit; a bony tubercle at angle of the mouth. Fingers long with a rudiment of a web and with distinct disks; first finger longer than the second by a distance equal to the width of its disk. Toes one third webbed: 1st (inner) toe barely webbed, 2nd to base of penultimate phalanx, 3rd to base of penultimate phalanx, 4th to point about half the length of proximal phalanx, 5th to base of penultimate phalanx; third toe slightly shorter than fifth, a single metatarsal tubercle; subarticular tubercles extending upon the metatarsal region as three or four flat warts; a small dermal heel flap; the tibio-tarsal articulation extends forward to nearly the tip of the snout. Neural spines of vertebræ raising the skin into a row of six tubercles on the back; skin on the head involved in cranial ossification, distinctly granular; skin of the back covered with slightly smaller granules; the upper side of the forearms covered with granules of the same size and strewn with a number of large tubercles; the outer edge of forearm ornamented with a row of tubercles which are continuous with a seam of skin along the outer edge of the hand; under side of both pairs of appendages smooth; throat covered with granules of the same size as those of the back, and strewn with a number of tubercles of various sizes; belly and sides of body coarsely granular, and provided with a number of thickly-set, low tubercles; a few tubercles on the legs tending to form regular transverse rows as in other species of *Cerathyla*, posterior faces of femurs granular. Color above (in alcohol) a dark reddish brown, head tinged with greyish yellow; six indistinct dark bars on each side of the upper lip; a few indistinct reticulations of the same color about the nostrils and around the tympanum; sides of the body ashy, reticulated with straw color, the large tubercles on the sides of this color; three ashy crossbars extending transversely across the contracted leg and contiguous with the three rows of tubercles. Ground color of throat reddish brown fading into a greenish yellow upon the belly; entire under surface reticulated with dark brown, indistinctly on the throat and definitely on the belly and appendages; the large tubercles of the throat straw color in sharp contrast to the general throat color; under surface of tarsus and metatarsus ashy, the tubercles tinged with white.

---

[1] Named in honor of the naturalist-engineer who made the collection.

Dimensions.

Tip of snout to vent	73.5 mm.
" " " " nostrils	8
" " " " anterior rim of orbit	16
" " " " posterior edge of tympanum	30
" " " " tip of occipital horn	39.5
Distance between tips of occipital horns	34
" " nostrils	4
" of nostrils from orbit	8.5
Interorbital width	10.5
Width of upper eyelid	6
Greatest width of head	36.5
Forelegs from axilla	47.5
Hindlegs from vent to tip of longest toe	123.5
Tibia	41

Notes on Paratypes.— Two other specimens of the series are males and although smaller than the female they have well developed gonads, associated with small fat bodies. The range of variation exhibited in the three specimens suggests that too great weight has been placed in the past upon the importance of tongue and head form in distinguishing species of *Cerathyla*. The larger of the males has its tongue broader than long and unnotched behind; the smaller longer than broad, but proportionately not so long as that of the female, and notched behind. The larger male is not so well preserved as the other, and this difference of tongue form may be due to shrinkage. The differences in head form may be seen in the illustration (Plate XCIII, Fig. 2). It is evident that some of the measurements given above, such as that from tip of occipital horn to end of snout cannot be of specific value if specimens of different size or sex are compared. There is probably individual variation in the development of the helmet for the male with the greatest body length has the less curved posterior margin to the casque, but it also has a narrower head than the other and may be a younger individual. The width of the upper eyelid does not vary in proportion to the size of the specimen. It is noteworthy that the tympanum varies little in orientation throughout the series and but slightly in size. The occipital horns are subject to so much variation that their measurements have been left out of the diagnosis while coloration has been given.

The coloration of the sides of the body seems to be a good specific character. In one of the males the coloration is nearly the same as that of the female. Although the color of the other male has faded considerably the dusky and white reticulations of the sides are very distinct. The dark bars on the lips and legs are conspicuous in the males, but there is no constant color difference between the sexes.

Remarks on Related Species.— *Cerathyla johnsoni* is apparently closely allied to *C. bubalus* Espada, but may be distinguished from it by 1. the granular dorsal surface, 2. more extensive webs between the toes, 3. longer snout and 4. different coloration. There may be a constant difference in the head form and leg length of specimens of the same sex. The interorbital width is probably wider in *C. johnsoni* than in *C. bubalus.* The difference in the webbing of the toes of these species is not great but very distinct if the figures of Espada (1875, Pl. 5, fig. 3) and Boulenger (1903, text fig. 8) may be relied upon. In the third and fifth toes of *C. bubalus* the web extends only two thirds the length of the proximal phalanx while in *C. johnsoni* it extends to the base of the penultimate phalanx. In the former species the fourth toe is webbed only to the base of the proximal phalanx while in the latter the web extends half the length of the same phalanx.

Cerathyla johnsoni needs comparison with no other species of *Cerathyla.* Future work may show that the great range of variation in this species is found in other species of *Cerathyla.* In that case some of the species described from Ecuador must be considered synonymous with other forms from the same region. The extreme range of variation in a species of Cerathyla is perhaps shown in the differences between the type of *C. panamensis* and the young one associated with it. Through the kindness of Dr. Stejneger I have recently examined these specimens. The tympanum of the young one is laterally not half posteriorly directed. The helmet is very small. The disks and snout flap are proportionately larger than in the adult. The under side is brown, not whitish as in the adult.

Habitat.— We have owed most of our knowledge of the habitat which *Cerathyla* frequents to the work of Espada (1871, p. 64), but even he has only informed us that the type specimens of several of his species were taken in palm trees or in the woods. We know from the works of travelers that villages like Archidona and Sumaco, the type localities of these species, are surrounded by luxuriant vegetation. But we have no exact information as to the habitat of *Cerathyla.* It was therefore of great interest to me to receive from Mr. R. D. O. Johnson a letter in which he graphically describes the region in which he collected the "arrow-headed frogs" described above. I quote directly from his letter:

"The temperature of this region is cool for the tropics, varying during the day from 58 to 68 degrees F. This might be called the second wet zone, the zones being of different elevations. The elevation of this region lay between 7500 and 8000 ft. above sea level. On account of the coolness and great amount of moisture ferns and mosses flourish. The surface of the ground is covered with a mass of decaying leaves, mosses, and ferns, the mass knitted together with a great abundance of fine roots. This covering is called 'capote' by the natives. It is in eternal shade and is soaked with water at all times. This 'capote' not only covers the ground but extends out on the lower limbs of the trees of the dense forest. Not infrequently when cutting and moiling one's tedious way along the side of a stream, one's foot may break through the 'capote' and through the hole thus made the turbulent stream is visible. It is in this 'capote' that the arrow headed frog makes his home.

"....The rain gauge records that were kept during my stay in the region of the Santa Rita showed a monthly precipitation of from 21 to 36 inches, as I remember now."

The stomachs of two of the specimens contained food. In the stomach of one of the males was a seed capsule 14 mm. long, nearly one half as long as the body cavity. This seed capsule I have not yet succeeded in having identified. It is very hard on the outside but the inside is pulpy with a number of seed arranged around an axial core. The stomach of the female contained a vegetable pulp similar to that inside of the seed capsule. No remains of animal food were present in either stomach.

Phylogenetic Position of Cerathyla.— The mere fact that *Cerathyla* is placed among the Hemiphractidæ chiefly because of the odontoids on the lower jaw tells us little about its phylogenetic position among the Salientia. The modern tendency is to regard as artificial associations several of the genera based upon the presence or absence of teeth. Some of the higher groups may be artificial. The family Dendrophryniscidæ is certainly an unnatural group of two very unlike genera: *Batrachophrynus* being closely related to *Telmatobius* and *Dendrophryniscus* to some genus of burrowing toads. At first glance *Cerathyla* appears to be an over-specialized Hylid which has developed teeth on all available bones. It has claw-shaped terminal phalanges, and Stejneger (1917, p. 33) has attributed dilated sacral diapophyses to one of the species.

If *Cerathyla* is an over-specialized genus it is not because of an over-favorable environment. Anyone who has been in such a region as Mr. Johnson has described must have been impressed by the paucity of vertebrate life. There are a few birds such as Trogans and Hummers which are adapted to this habitat, but the vast majority of the vertebrates occur only along the edge or upon the roof of the jungle.

Our knowledge of the internal structure of *Cerathyla* has been confined almost entirely to the two or three sketches of Espada (1875, pl. 4). A few notes on some of the structures of *C. johnsoni* may be of interest from a systematic point of view. There is practically no variation in the sexes. The figures were made from the type specimen and from the largest male.

The pectoral girdle is very peculiar. Although no omosternum is represented in Espada's figure of the sternal apparatus which he considers typical for the genus, the structure is present but small and weak. There are no muscles attached to it. The most extraordinary feature of the pectoral girdle is the long anterior processes of each of the epicoracoid cartilages. These fit one over the other. They are very firm and each forms the attachment for two well developed muscles. Both muscles are attached at their distal end to the humerus, the most posterior muscle much nearer the glenoid cavity than the other. Not all of the proximal end of the posterior muscle is attached to the epicoracoid process, about one half of it is attached to the epicoracoid cartilage in the region of the clavicle. While the epicoracoid cartilage is wide it is not so wide as represented in Espada's figure. The pectoral muscles cover the greater part of the epicoacoids and separate them from each other. A few strands of tissue connect the two halves of the girdle at the extreme anterior end of the epicoracoids and at a few points on their edges, but this attachment is elastic and allows a maximum amount of free movement. The ventral half of the girdle may be readily lifted from the dorsal.

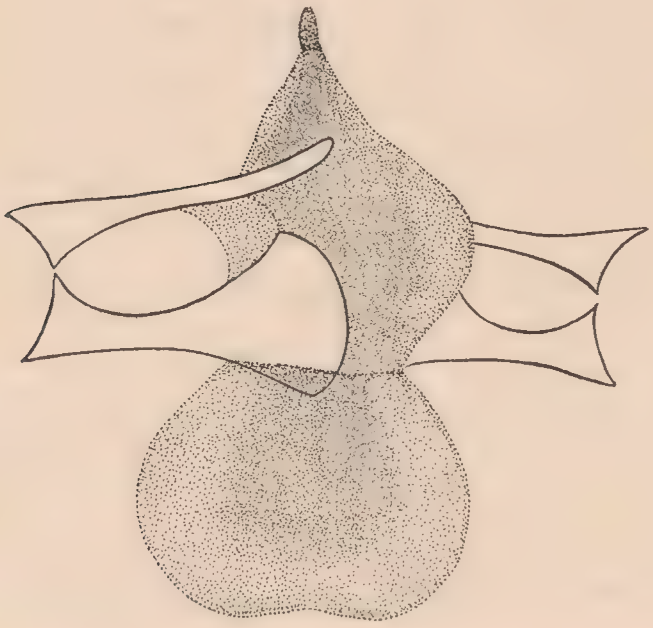


Fig. 2. *Cerathyla johnsoni*, ventral view of shoulder girdle.

The sacral diapophyses, as shown in the figure, are scarcely dilated but they are slightly flattened. The ilia project normally somewhat beyond the diapophyses. The impression of the tissue connecting ilia and diapophyses is made upon the skin, and without dissection one would think that the sacral diapophyses were strongly dilated. The vertebræ are procœlous, unlike those of *Hemiphractus*. The coccyx articulates upon two condyles. The terminal phalanges are not typically claw-shaped but are nearly straight and flattened at the base.

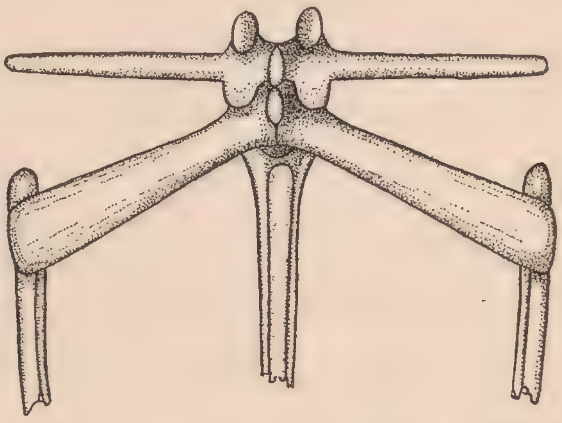


Fig. 3. *Cerathyla johnsoni*, dorsal view of sacral vertebra *in situ*.

Here in *Cerathyla,* a most specialized batrachian, we find a non-dilated terminal phalanx. It is to be expected after the change in phalanx form which we have seen in *Leptodactylus lineatus* that the non-dilated phalanx would be associated with specialization. There are many species of *Eleutherodactylus* having much larger digital pads than *Cerathyla,* and yet retaining the T-shaped terminal phalanges. Phalanx form is probably in this case not due to digital form. The sacral diapophyses and vertebræ are characteristic of the Leptodactylids; the pectoral girdle has some features in common with that of *Hemiphractus*. It is most reasonable to assume that *Cerathyla* owes the sum-total of its internal characters not to any Hylid stock but rather to Leptodactylid ancestry. If this is a correct assumption, it is interesting that during all the differentiation of head form and phalanx form the sacral diapophyses have remained nearly cylindrical.

3. The Status of Hyla fuhrmanni Peracca, with Remarks upon the Homology of its Larval Structures.

Plate XCIV.

Hyla fuhrmanni has been known to science only a very short time. Peracca (1914, p. 108) made the single specimen which Fuhrmann and Mayor brought back with them from Colombia the type of the species. This specimen was a female carrying eggs upon its back. Ruthven (1915) secured in the Santa Marta Mountains two more specimens each with eggs upon the back. The broods were in different stages of development and Ruthven made an excellent study of his material. The American Museum has received from Mr. R. D. O. Johnson a series of four specimens of *Hyla fuhrmanni* collected near the type locality. One of these specimens is an adult female carrying eggs upon the back, another is an adult female without eggs, while the remaining two are adult males. These are the first males of the species which have ever been recorded.

The males are much smaller than the females, measuring 51 millimeters from snout to vent against 67.5 millimeters. They are nevertheless sexually mature. The gonads are well developed, but the fat bodies of one specimen are very much smaller than those of the other. The female without eggs on its back has well developed gonads, the ova being conspicuous although not free in the coelom. There do not seem to be any constant color differences between the sexes, and the relative proportions are about the same.

The habitat of *Hyla fuhrmanni* is evidently the soaking forests which cling to the steep sides of many Colombian ravines. Ruthven, Fuhrmann, Mayor, and Johnson found their specimens under somewhat similar conditions. Ruthven (1915, p. 2) states that both of his specimens were found "on the steep bank of a mountain stream at an altitude of 4500 feet on the mountain of San Lorenzo." Fuhrmann and Mayor (1914, p. 50) show us in their several photographs of the environs of Guaca the kind of habitat in which the type specimen was taken. Johnson found his specimens associated with *Cerathyla* in the Santa Rita Valley. A description of this region has been given above, and some of Mr. Johnson's photographs are reproduced on Plates XCV and XCVI.

One of the adult females contained in its stomach one cockroach, one spider, and two chilopods. Mr. Roy W. Miner has kindly identified the chilopods as *Otosignus scabricaudus* (Humbert and Saussure). Although the bite of chilopods is more or less poisonous, they are sometimes eaten by chickens. It is to be supposed that a tree-toad would be much more susceptible to the poison of a chilopod, and yet this specimen had eaten two. The stomach of one of the males contained fragments of grasshopper legs and wings.

The peculiar transverse vomerine teeth possessed by *Hyla fuhrmanni,* the short stubby head and large eyes impressed me as unlike those of any *Hyla* with which I was familiar. A dissection of one male and one female showed conclusively that this species should no longer be referred to the genus Hyla. The sacral diapophyses instead of being dilated are cylindrical. The pectoral girdle is arciferous but the sternum is much reduced. Claw-shaped phalanges are present, but the vomerine teeth are peculiar and apparently do not fall within the range of variation exhibited by the known species of Hyla.

The species must be referred to the genus *Hyloscirtus.* Peters (1882, p. 107) described the genus *Hylonomus,* but since that name was preoccupied he changed the name to *Hyloscirtus* (1882a, p. 127). The genus is characterized in part by having sacral diapophyses non-dilated, terminal phalanges with a "simple point." Peters summed up his diagnosis with the remark: (trans.) "next to *Hylodes,* it is distinguished from this genus through its well developed webs." Peters doubtlessly intended *Hylo-*

scirtus to be a new genus of Leptodactylidæ for he compared it with *Hylodes*, but he does not comment upon the family relationship of the genus.

Nothing more appears in literature in regard to these peculiar tree-toads until Ruthven (1916, No. 33) described a new genus and species of Leptodactylids from the Santa Marta Mountains of Colombia. This genus, *Cryptobatrachus*, is synonymous with *Hyloscirtus* for it has the same cylindrical diapophyses and non-dilated terminal phalanges. The species are apparently closely related. The presence of a tympanum in *Cryptobatrachus boulengeri* and the absence in *Hyloscirtus bogotensis* is a character of hardly specific value in many genera of mountain frogs, *e. g.*, *Telmatobius*.

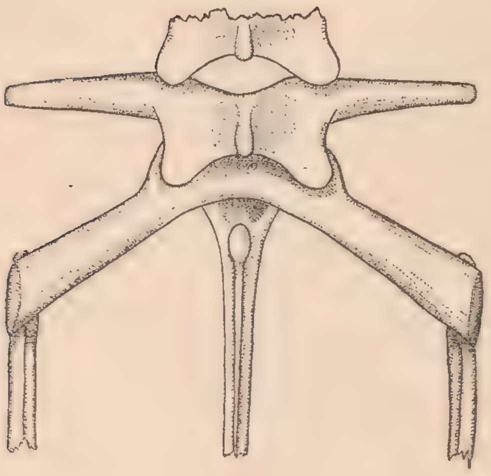


Fig 4.

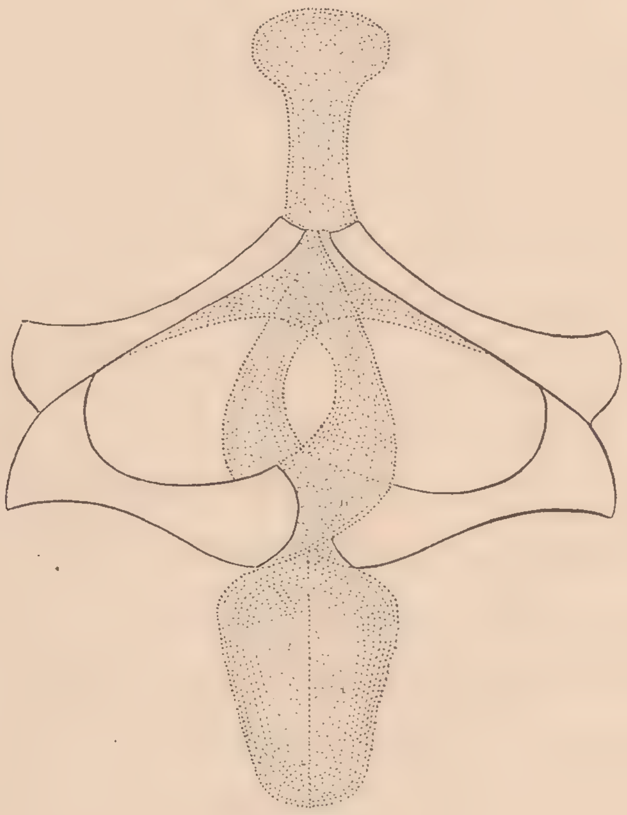


Fig 5.

Fig. 4. *Hyloscirtus fuhrmanni*, dorsal view of sacral vertebra *in situ*.
Fig. 5. *Hyloscirtus fuhrmanni*, ventral view of shoulder girdle.

The three species of *Hyloscirtus* may be distinguished from one another by the following key.

a. Tympanum hidden.................................. *H. bogotensis* Peters.
a^1. Tympanum distinct.
  b. Interorbital space much broader than upper eyelid. . *H. boulengeri* (Ruthven).
  b^1. Interorbital space less than width of upper eyelid. . *H. fuhrmanni* (Peracca).

Hyloscirtus fuhrmanni has several features in common with the Hylids, especially with species of the genus *Hyla*. There is a constant difference in size between the sexes,—a difference such as that in *Hyla baudinii*. The terminal phalanges of *H. fuhrmanni*, as well as those of *H. boulengeri* are claw-shaped, while the same condition probably exists in *H. bogotensis*. Several species of *Hyla* carry eggs attached by their membranes to the back of the nurse. The pectoral girdle is *Hyla*-like but the sternum is reduced even more than that of *H. albomarginata*.

Ruthven referred *Cryptobatrachus* without comment to the Leptodactylidæ. Peters pointed out the relationship of *Hyloscirtus* to *Eleutherodactylus*. There are several reasons why *Hyloscirtus* should be referred to the Leptodactylidæ. In that family the range of generic variation is greater than in the Hylidæ. The sacral diapophyses of the Leptodactylids are cylindrical or only slightly dilated. A wide webbing between the toes exists in several species of Hylodes. Boulenger (1898, p. 119) commenting upon the status of *Hylodes anomalous* says:

"This species differs so much from the other members of the genus Hylodes in the extensive web between the toes that it might be made the type of a new genus. I am, however, unwilling to adopt such a course at present in view of the existence of the species *H. palmatus* and *H. raniformis* which afford a link between this and the more typical forms, and render the character of the development of the web between the toes one of very doubtful value in this group, a conclusion which is further strengthened by a study of several other genera of tailless Batrachians."

Hyloscirtus possesses non-dilated phalanges,— claw-shaped in at least two of the species. Is that not what we should expect in a highly specialized Leptodactylid if we hold to our theory of phalanx evolution stated above? *Hyloscirtus* is a genus confined to the forested ravines of Colombia. This environment has developed several giant species of *Eleutherodactylus* as well as a *Cerathyla*. It is evidently an environment which fosters overdevelopment and specialization. *Hyloscirtus* has the cylindrical sacral diapophyses of the Leptodactylids but the claw-shaped terminal phalanges of the Hylids. We have already concluded that in *Cerathyla* the form of the sacral diapophyses was of more diagnostic value than the shape of the terminal phalanges. To be consistent we must consider *Hyloscirtus* a highly specialized Leptodactylid genus.

When I received the specimens of *H. fuhrmanni* only one egg was in place upon the back of the female. But there were twenty-six shallow hollows in the dorsal integument of the specimen. Several eggs were free in the container. All of the eggs proved to be in a late gastrula stage.

The embryo in this stage is modeled very low upon the large yolk, suggesting a ganoid type of egg. In most specimens the neural tube is closed over and the embryo is marked off from the yolk by a slight furrow on either side. The embryo is banjo shaped. The neural fold ends in a pair of optic lobes resting upon the large circular head piece which is also separated from the yolk by a slight furrow. The blastopore is closed. A curved furrow extends posteriorly from the embryo, probably marking the gastrula lips. The embryo is pigmented with black, which places it in strong contrast with the yellowish unpigmented yolk. In *Hyloscirtus* *fuhrmanni* the embryo is much smaller in comparison with the yolk than in *Phyllomedusa hypochondrialis* as described by Budgett (1899, Pl. 30). This condition is to be expected since both Peracca and Ruthven have shown that the young undergo their entire metamorphosis while enclosed within the egg membranes upon the nurse's back.

That the young receive all of their nutriment from the yolk is very probable. Not only do the several egg membranes separate the young from the nurse, but the dorsal integument is in no way differentiated. The squamous epithelial cells and stoma cells are similar to those on other parts of the integument. Ruthven and Peracca have both shown that the eggs are "glued to the nurse frog by a gelatinous substance." The substance is histologically undifferentiated and apparently is part of the egg membranes. Several of the eggs which had been torn from the nurse had a thin layer of epithelial cells attached to their tertiary membranes. This shows how firmly the eggs are attached to the integument.

The observations made by Ruthven upon the later embryonic life of *Hyloscirtus fuhrmanni* are of especial interest from a phylogenetic point of view. He has shown that the young are provided while in the egg membranes with special cup-shaped gills. These are of course homologous with the bell-shaped gills of *Gastrotheca oviferum* described by Weinland (1854, p. 457) and of *G. cornutum* considered by Boulenger (1898, p. 124, pl. 18). Similar organs are found in the larvæ of *G. marsupiatum* and *G. plumbeum* (see Brandes and Schoenichen, 1901, p. 444). *Cerathyla bubalus* and *Hyloscirtus fuhrmanni* have no dorsal pouch and yet they possess these peculiar bell-shaped gills. Ruthven has figured the gills *in situ* and has shown that they cover the embryo like an allantois. It is certain that these gills are breathing organs but it is not so certain why similar organs have developed in those species which take oxygen from the air and those which apparently absorb it from the body of the mother.

There are other species of tree-toads which carry the eggs upon their back like *Hyloscirtus fuhrmanni.* Their larval histories have not been studied so fully as in the case of *Gastrotheca oviferum.* Goeldi (1895, p. 95) worked out the life history of *Hyla goeldii* and compared its larval stages with those of *Hylodes martinicensis.* In this he implied that the development was direct and that no gills were found. But Boulenger (1904, p. 106) in describing *Hyla evansi* states:

"The unique specimen, a female, carries its eggs on the back, fitting into shallow hexagonal impressions in the skin; these eggs, 22 in number, measure 8 or 9 millimeters in diameter and contain tailed larvæ with rudimentary limbs, and with allantois-like, membranous, respiratory organs. In this it agrees with *Hyla goeldii* Blgr., to which it is nearly related and with *Ceratohyla bubalus* Esp."

One of the more recently described egg-carrying tree-toads, *Hyla ohausi* Wandolleck, is unique in having a superabundance of "jelly" which not only glues the eggs to the back of the female nurse but holds the eggs together in a single mass. Wandolleck (1907, p. 15) comments briefly upon the larval history comparing it with that of *Hyla goeldii*, but he says nothing about the form of gills.

Stejneger has very recently described from Panama a new *Cerathyla* which had young attached to the back previous to capture. He says (1917, p. 33) in part:

"With the adult specimen described above, there is a very young one only 17 mm. long but fully developed. It has evidently just been severed from its mother, as two strings, issuing on either side from the chest near the shoulder look as if they had just been ruptured. When received, the mother specimen had the back covered with a loose flap of skin which came off easily when gently lifted by the forceps. On the exposed side of this flap there are about 12 pairs of whitish cords, apparently freshly ruptured and similar to the ones on the chest of the young one, which indicate that at least so many young ones had been attached to the mother's back just previous to capture. This condition fully bears out the account given by Boulenger of the closely related *Cerathyla bubalus* carrying its eggs on the back.... The young ones evidently undergo their entire development while attached to the mother, after which the skin of her back, to which the eggs adhered sloughs off. On the piece of skin shed there are distinct impressions of the outlines of the eggs, apparently at least 14. This would indicate a larger number of eggs than in *C. bubalus*, in the specimen of which recorded by Boulenger there were only 9."

Dr. Stejneger has very kindly not only allowed me to study the type specimen and young one, but he has given me to section a piece of the skin which he lifted from the adult. For staining some of the serial sections made from this piece I used Hansen's Hæmatoxylin and for others Delafield's. The counterstain was eosin. In Figs. 6 and 7 there are represented different parts of a single section made through the sheet of tissue at a point where the cord joined it.

The sections show conclusively that this dorsal sheet of tissue which looks very much like skin is really a mass of egg membranes, very much shriveled and covered with dirt. Each hollow in the sheet contains a single gill homologous no doubt to those of the tree-toads already discussed. The gills lie in their normal positions, separated from the ventral surface of the sheet by several thick layers of structureless substance,—the egg membranes. Each gill extends only the length of one hollow. The outer edge of a gill is shown in Fig. 7. The gelatinous layers are not continuous between hollows, although the basal sheet is very regular. The gill consists largely of capillaries. Each gill has two cords associated with it. The capillaries of the gills are supplied usually by four blood vessels from each cord, but I have not examined enough material to state if this number is constant for every gill cord. The blood vessels of each cord apparently anastomose in the gill with those of the other. The cords contain striated muscle fibers of a simple type having only a few large nuclei to each fiber. As shown in Fig. 7, the muscle fibers crowd the blood vessels into the center of the cords. The muscle fibers do not extend deeply into the gill, but end abruptly near the point of junction of the cord with the gill. The lumen in the cords may be due to the poor fixation of the tissue. The lumen between the gill and egg membranes is often filled with coagulated lymph containing white

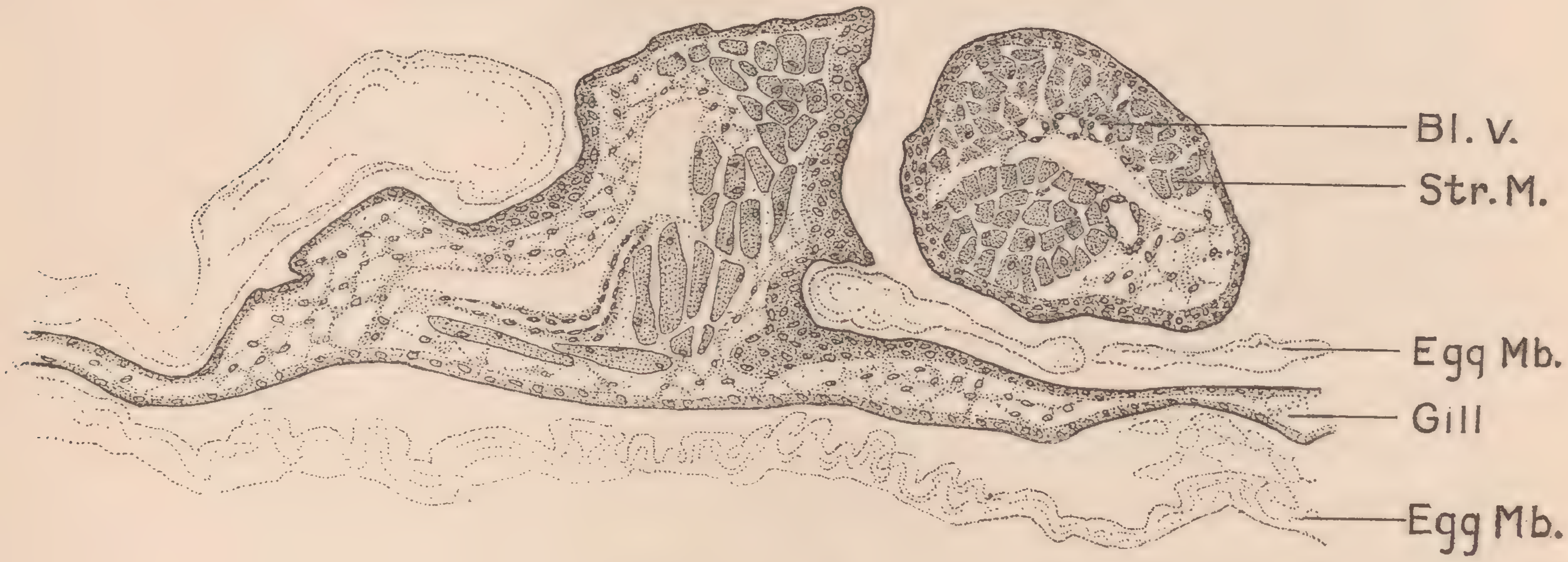


Fig. 6. $\frac{106}{1}$.

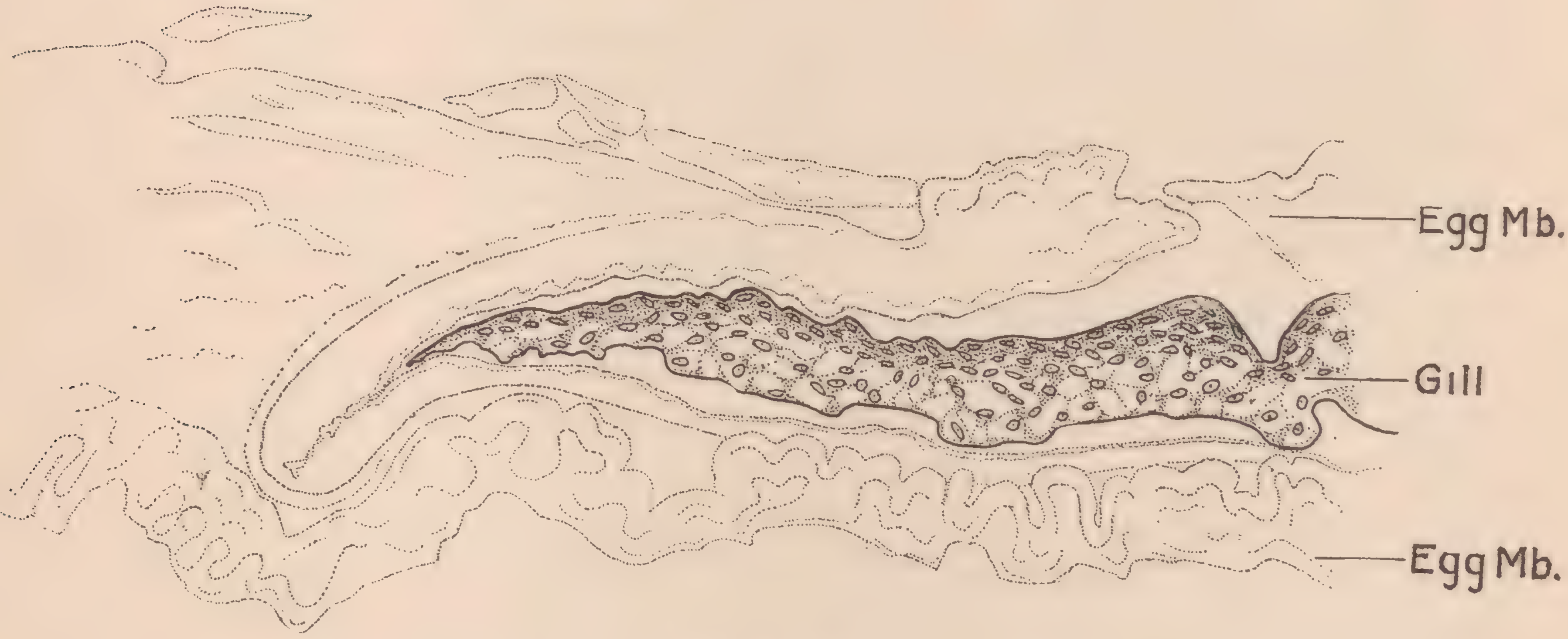


Fig. 7. $\frac{184}{1}$.

Figs. 6 and 7. Sections through dorsal cover of the type specimen of *Cerathyla panamensis* Stejneger.

blood corpuscles. For the sake of clearness this lymph is not represented in the drawings.

Each of the two strings issuing from the neck of the young one is really a double string twisted in the fashion of a curtain cord. The two components of each string are widely separated at their point of fusion with the gill, and form the pair of cords described above. Stejneger has pointed out that there were at least 12 pairs of cords issuing from the sheet of tissue. Corresponding with these 12 pairs of cords, there could have been only six young ones attached to the mother. Each hollow does not mark the position of an egg but rather of half an egg. It is the depression formed by the gill after it has collapsed with the egg membranes.

It was impossible to float the gills in water to study their exact shape. Probably the whole sheet of tissue is an abnormal structure,— a mass of egg membranes and their associated gills very much distorted by unnatural causes. In no species of tree-toad carrying eggs on the back has it been shown that the gill cords are ruptured to free the young ones from the egg membrane. (The work of Brandes and Schoenichen, 1901, is diagrammatic and untrustworthy). There is no information available as to the treatment which the type specimen of *Cerathyla panamensis* received just after capture.

The serial sections of the gills have brought out the close similarity between the larval structures in *Cerathyla panamensis* and *Gastrotheca oviferum*. Weinland (1854, pp. 451–463) has studied the anatomy of the larvæ of the latter species. The gills in *G. oviferum* are cup-shaped and are connected with the neck of the young one on each side by two cords which as in *C. panamensis* contain striated muscle fibers. Weinland suggests that the striated muscle of these organs may be functional only in later larval life. By analogy with what occurs in *Hyloscirtus fuhrmanni* it seems more probable that these muscles are used for pulling the huge "bell gills" into the gill chamber just after the young tree toad has escaped from the egg membranes. It is indeed hard to imagine what function the muscle tissue could have during the embryonic life of the individual. In each gill cord of *G. oviferum* there are only two blood vessels, while in *C. panamensis* there are apparently four. Whether this is a constant difference has not been determined. In both species there occurs the same anastomosing capillaries, the same lymph space separating the gills from the egg membranes, and probably some of the egg membranes from one another. It is evident that no different larval structures are required for taking oxygen from the air as in the case of *Cerathyla*, or for absorbing it from the body of the parent as in *Gastrotheca*.

In all of the various species of tree-toads which carry eggs on the back those larvæ which have been critically studied have been found to possess cup-shaped gills. Some species of *Gastrotheca* complete their larval development in the water. This does not destroy the similarity of the early larval structures in these species. If Boulenger's statement is correct in regard to the gills of *Hyla goeldii,* the one doubtful case is eliminated and we may conclude that direct larval development is not associated in tree-toads with the type of nursing habit under consideration. It is therefore not probable that the mode of development exhibited by *Eleutherodactylus martinicensis* is transitional to that of *Hyla goeldii.*

Boulenger (1895, p. 209) has shown that the skin on the back of *H. goeldii* "is expanded into a feebly reverted fold which borders and supports the egg mass on the sides, thus suggesting an incipient stage of the dorsal pouch of the allied genus *Nototrema*." Boettger (1893, p. 41) considered *Gastrotheca pygmæum* to have developed its dorsal pouch from just such inverted folds. On the other hand Andersson (1911, p. 5) maintains that the pouch of *Gastrotheca* was formed by an invagination on the posterior end of the back. It would be vain to speculate on that problem now; there is nothing in the ontogeny of *Hyloscirtus fuhrmanni* which suggests how the invagination might take place. In no species of non-pouched forms has the dorsal integument been found to be specialized. Boulenger (1903, p. 116) says of *C. bubalus:*

"The eggs in this *Cerathyla* simply stick to the back, leaving shallow hexagonal impressions on the much thinned dorsal skin, through which the neural processes project to such an extent as to leave marks on the vitelline sacks with which they are in contact."

But since the neural processes project in a similar manner in both sexes of *C. johnsoni* although the specimens were apparently well preserved, we may conclude in default of histological study that the skin of Boulenger's specimen of *C. bubalus* was probably normal.

What is the significance of the fact that in all tree-toads carrying eggs on the back the larval structures developed are practically the same? These structures are very different from those of *Pipa,* which, as is well known, carries the eggs on the back. In this discussion we have limited ourselves to the genera *Hyla, Gastrotheca, Amphignathodon, Cerathyla,* and *Hyloscirtus.* The first three of these genera undoubtedly came from a Hylid stock, but it has been the purpose of this paper to show that the other two genera arose from a very different stock, or perhaps stocks. Does this identical embryonic life show that our system of classification is inadequate and that after all the five genera form a natural group?

If we consider the breeding and nursing habits in other batrachians, we shall find cropping out similar larval histories in entirely unrelated groups (see Sampson, 1900). *Chiromantis rufescens* and *Phyllomedusa iheringii* both deposit their eggs on trees in nests made of leaves. *Dendrobates braccatus* and several species of *Prostherapis* are nearly alike in form and color. It is well known that they carry their young while in the tadpole stage upon their backs. Under adverse conditions many different groups of batrachians have abbreviated larval histories. *Eleutherodactylus martinicensis* and *Rana opisthodon* have direct development. *Eleutherodactylus petropolitanus* and *Hyla abbreviata* are said to have larvæ adapted to living among moist rocks. These tadpoles are provided with a ventral adhesive disk and are the color of stone. *Rhacophorus schlegeli* and *Leptodactylus mystacenus* deposit their eggs in damp holes in the ground. The later histories of the larvæ are somewhat the same. In *Xenopus lævis* and *Pipa americana,* although only distantly related, the tadpoles agree in having fore limbs free from the operculum and in having two spiraculæ. This similarity may be due to the aquatic habits of the two species. Few of the life histories of the mentioned batrachians have been intensively studied, and we are not able to draw the close comparison which we can in the case of *Gastrotheca* and *Cerathyla.*

If *Cerathyla* and *Hyloscirtus* are not related to the Hylids, it is evident that the bell-shaped gills and related larval organs of these batrachians which carry their eggs on the back, have no real genetic relationship but have developed independently in different groups. We do not know whether this convergent evolution has been brought about by external or internal factors. Is the bell-gilled larva a form moulded in different groups by some potent factor in the environment, or is it the one end of several distinct lines of internal specialization? This question cannot be answered satisfactorily. We can only conclude that *Hyloscirtus, Cerathyla,* and *Gastrotheca* are the ends of three lines of specialization and in spite of this fact they have developed similar larval breathing organs. In the last two genera, although the eggs of one are exposed to the air, and of the other are covered by a fold of skin, these larval structures are nearly identical.

Literature Cited.

Andersson, Lars Gabriel.

1911. A New Leptodactylus and a New Nototrema from Brazil. Ark. Zoöl. Stockholm, **7**, # 17, pls. 1 and 2.

Barbour, Thomas.

1909. On the True Status of the Genus Cacopoides. Proc. Acad. Nat. Sci. Philadelphia, 401–405, pls. 17 and 18.

Boettger, O.

1893. Reptilien und Batrachier aus Venezuela. Ber. Senckenberg. Ges., 35–42.

Boulenger, G. A.

1882. Catalogue of the Batrachier Salientia of the British Museum, London.

1891. Notes on American Batrachians. Ann. Mag. Nat. Hist., (6) **8**, 453–458.

1895. On the Nursing Habits of Two South American Frogs. Proc. Zool. Soc. London, 209–210, pl. 10.

1898. List of Reptiles and Batrachians Collected by Mr. W. F. H. Rosenberg in Western Ecuador. Proc. Zool. Soc. London, 107–126, pls. 10–18.

1903. On the Nursing Habits of a South American Frog. Proc. Zool. Soc. London, pt. 2, 115–116, fig. 8.

1904. Description of a New Tree Frog of the Genus Hyla from British Guiana, Carrying Eggs on the Back. Proc. Zool. Soc., London, pt. 2, 106, pl. 5.

Budgett, John Samuel.

1899. Notes on the Batrachians of the Paraguayan Chaco, with observations upon their Breeding Habits and Development, especially with regard to *Phyllomedusa hypochondrialis* Cope. Also a Description of a New Genus. Quart. Journ. Micr. Sci. (N. S.), **42**, 305–334, pls. 28–32.

Brandes, G., and Schoenichen, W.

1901. Die Brutpflege der Schwanzlosen Batrachier. Abh. Naturf. Ges. Halle, **22**, 394–461, pls. 2–4.

Cope, E. D.

1862. On some New and Little Known American Anura. Proc. Acad. Nat. Sci. Philadelphia, 151–159.

Daudin, F. M.

1803. Histoire Naturelle des Reptiles. Paris.

Despax, R.

1911. Mission géodésique de l'Equateur. Collections recueilles par M. D. Rivet. Batraciens anoures. Bull. Mus. Paris, 90–94.

1911a. Mission du Service Geographique de l'Armée pour la Mesure d'un Arc de Meridien Equatorial en Amerique du Sud, sous le Controle Scientifique de l'Academie des Sciences, 1899–1906, **9**.

Duméril, A. M. C. et Bibron, G.

1841. Erpétologie Générale, **8**. Paris.

Fitzinger, L.

1843. Systema Reptilium.

Fuhrmann, O. and Mayor, E.

1914. Voyage d'Exploration scientifique en Colombie. Mem. Soc. neuchâteloise des Sci. nat., **5**.

Goeldi, Emil R.

1895. Contribution to the Knowledge of the Breeding Habits of Some Tree Frogs (Hylidæ) of the Serra dos Orgãos, Rio de Janeiro, Brazil. Proc. Zool. Soc. London, 89–97.

Guenther, Albert.

1858. Catalogue of Reptiles. London.

1859. List of Cold-Blooded Vertebrata collected by Mr. Fraser in the Andes of Western Ecuador. Proc. Zool. Soc. London, 89–93.

Jimenez de la Espada, Don Márcos.

1871. Faunae neotropicalis species quaedam nondum cognitae. Jorn. Sci. Math. Phys. e Nat. Lisboa; **3**; 57–65.

1875. Vertebrados de Viaje al Pacifico, Batracios. Madrid.

Merrem, Blasio.

1820. Tentamen systematis amphibiorum. Marburg.

Peracca, M. G.

1904. Viaggio del Dr. Enrico Festa nell Ecuador e regioni vicine. Boll. Mus. Zool. Anat. comp. Torino, **19**, # 465.

1914. Reptiles et Batraciens de Colombie. (In Fuhrmann and Mayor, Voyage d'Exploration scientifique en Colombie). Mem. Soc. neuchâteloise des Sci. nat., **5**, 96–111.

Peters, W.

1882. (....Eine neue Gattung von Batrachier, Hylonomus, aus Bogota). SB. Ges. Naturf. Fr. Berlin, 107–109.

1882a. (Herr W. Peters schlug vor den Namen der Batrachier Gattung Hylonomus in Hyloscirtus), *op. cit.*, 127.

Ruthven, Alexander G.

1915. Observations on the Habits, Eggs and Young of *Hyla fuhrmanni* Peracca. Occ. Papers, Museum of Zoology, University of Michigan, # 14.

1916. A New Genus and Species of Amphibian of the Family Crystignathidæ. Occ. Papers, Museum of Zoölogy, University of Michigan, # 33.

Sampson, Lilian V.

1900. Unusual Modes of Breeding and Development among Anura. Amer. Nat., **34**, 687–715.

Schneider, Gottlob.

1799. Historiae Amphibiorum.

Shaw, George.

1802. General Zoology, **3**, pt. 1, Amphibia.

Stejneger, Leonhard.

1904. The Herpetology of Porto Rico. Rep. U. S. Nat. Mus. [1902.] 553–724, pl. 1.

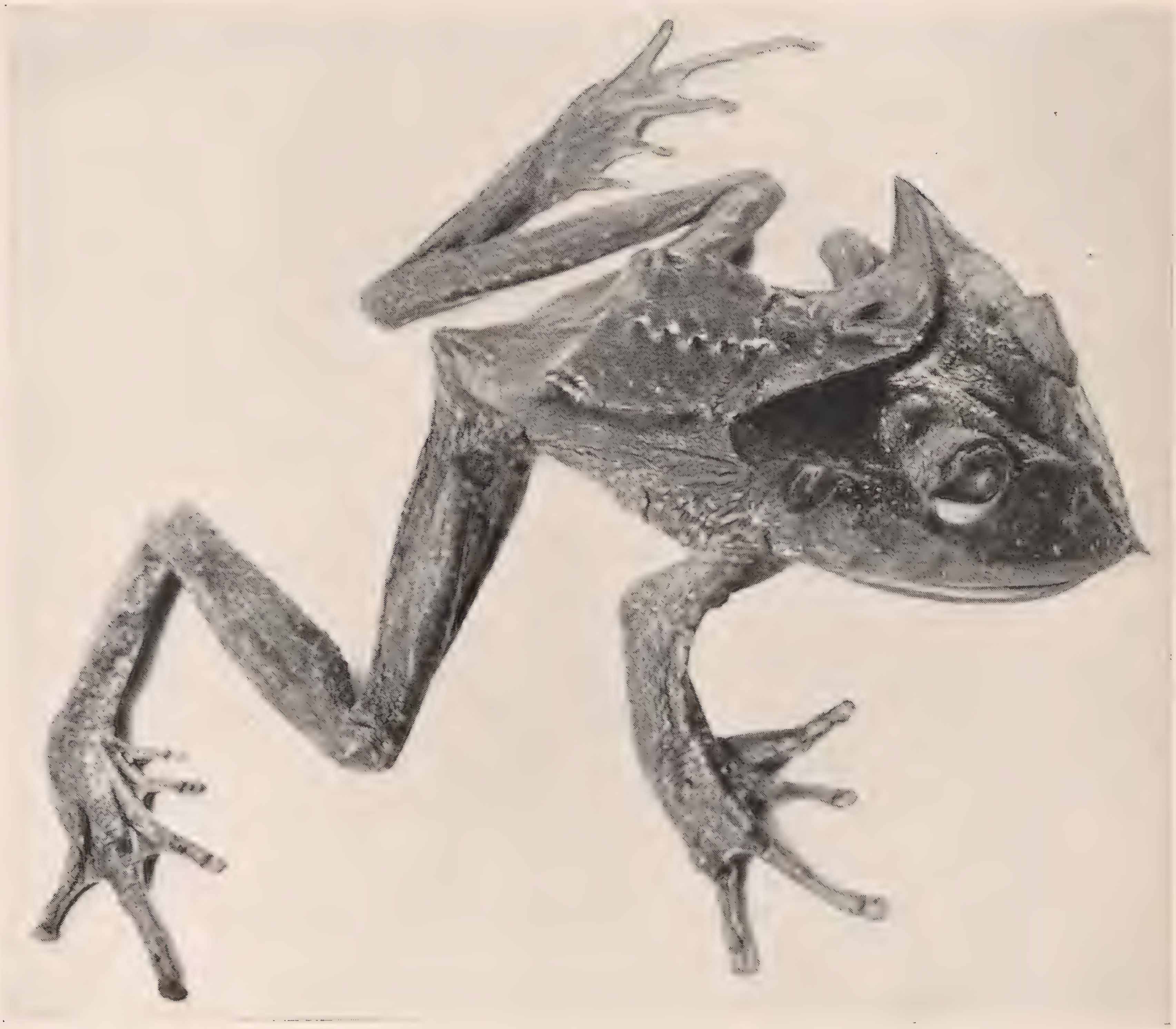
1917. A New Species of Horned Tree-Toad from Panama. Proc. Biol. Soc. Washington, **30**, 31–34.

Wandolleck, Benno.

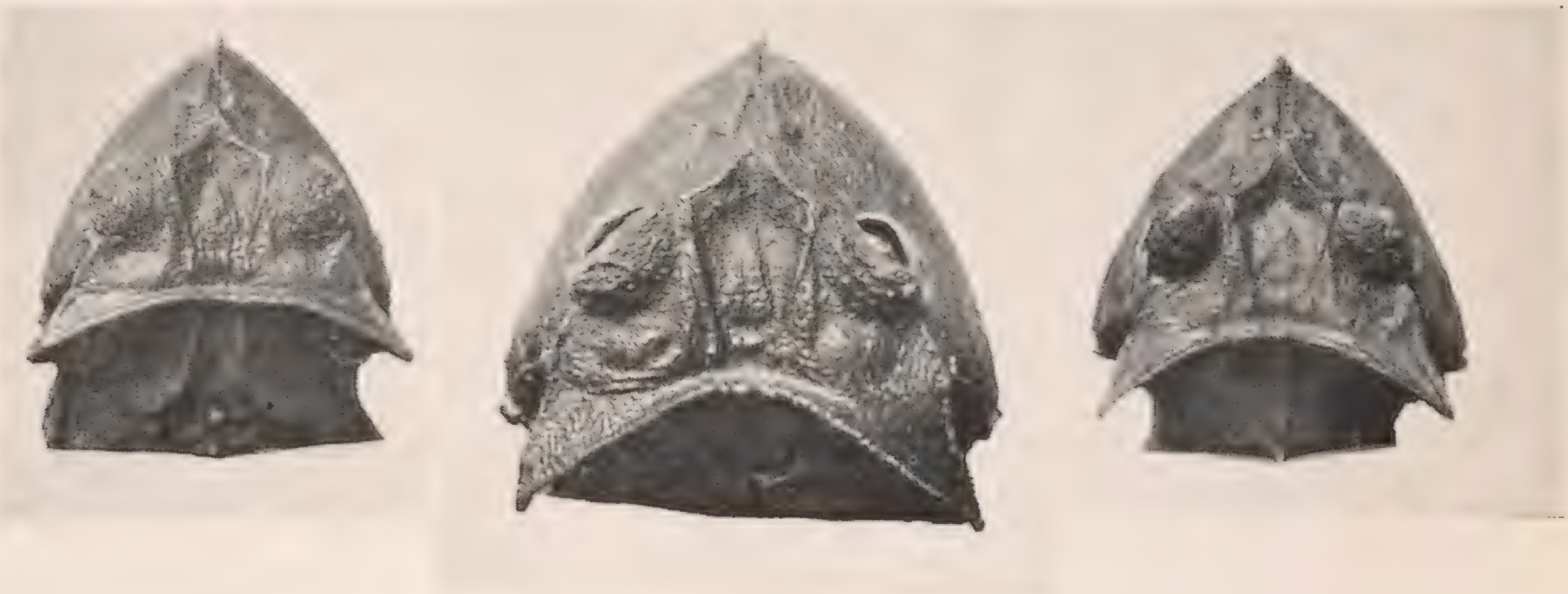
1907. Einige neue und wenige bekannte Batrachier von Brasilien. Abh. u. Ber. d. K. Zool. u. Anthr.-Ethn. Mus. zu Dresden, **11**, # 1, pl. 1.

Weinland, David Friederich.

1854. Ueber den Beutelfrosch. Arch. f. Anat. Phys. und Wiss. Med. Berlin, 449–477, pls. 17–19.



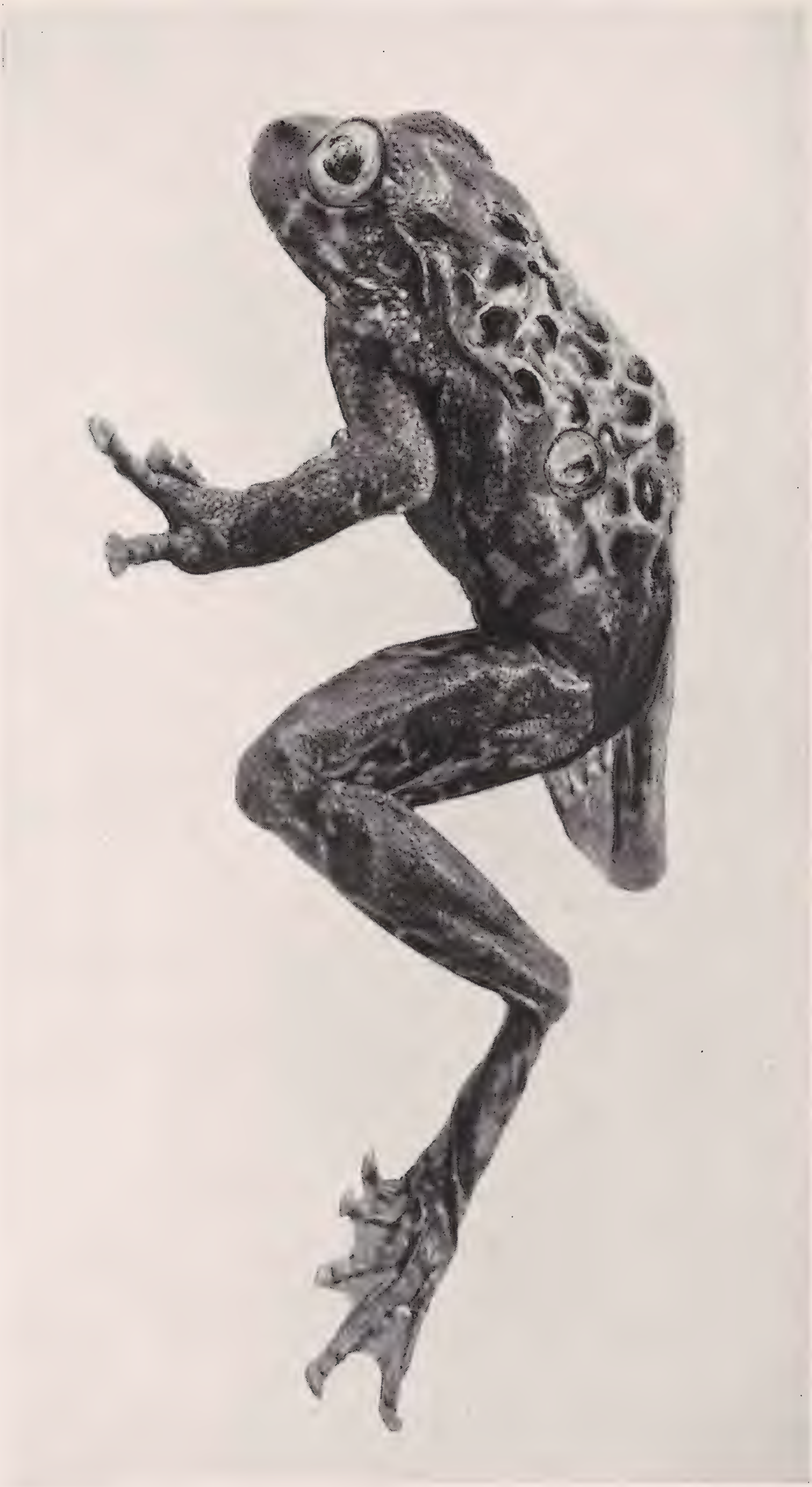
1



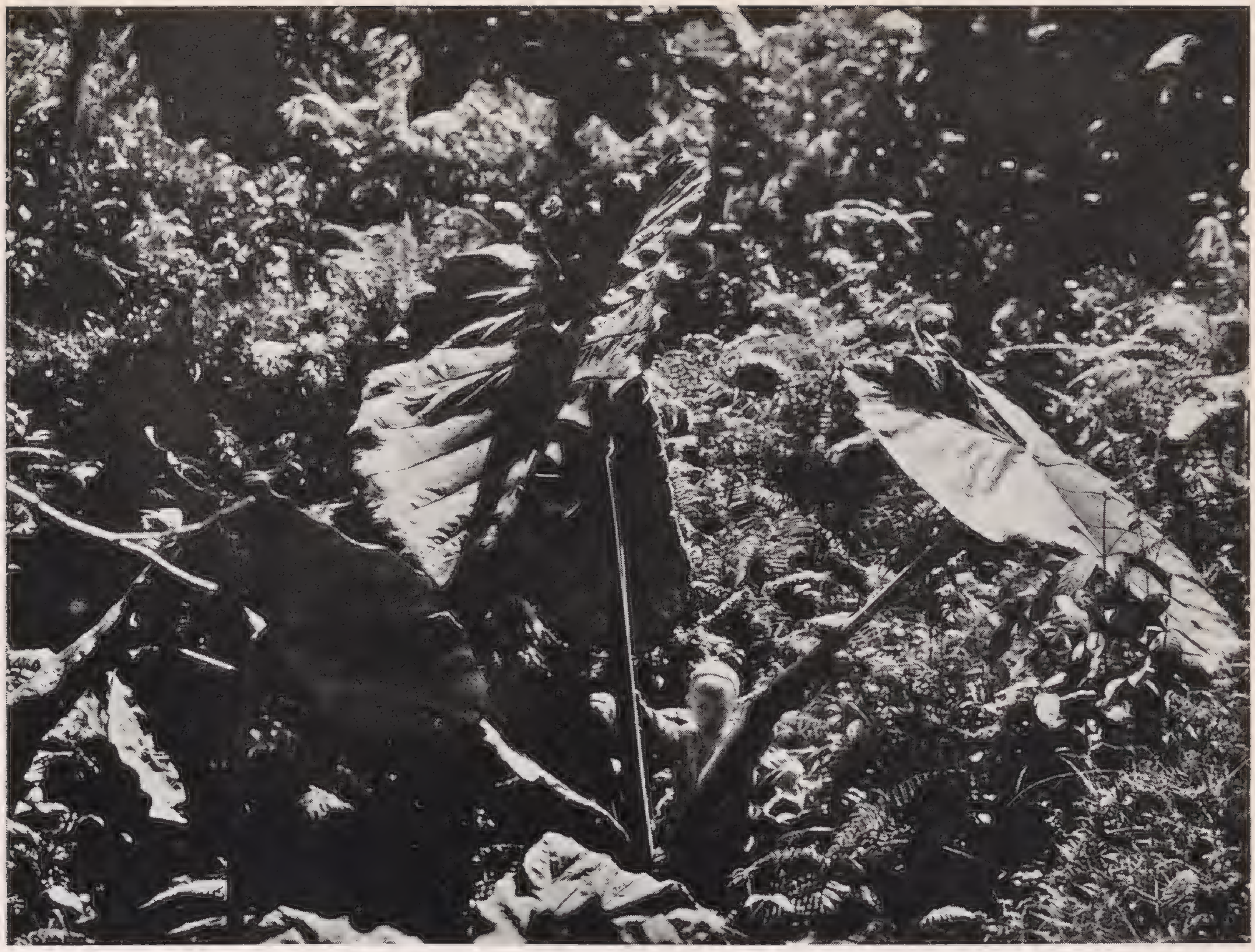
2

Fig. 1. *Cerathyla johnsoni* sp. nov. Type, A. M. N. H. No. 1341.

Fig. 2. *Cerathyla johnsoni* sp. nov. Type and paratypes, showing differences in head form. A. M. N. H. Nos. 1341–1343.



HYLOSCIRTUS FUHRMANNI (*Peracca*). A. M. N. H. No. 1337.


1

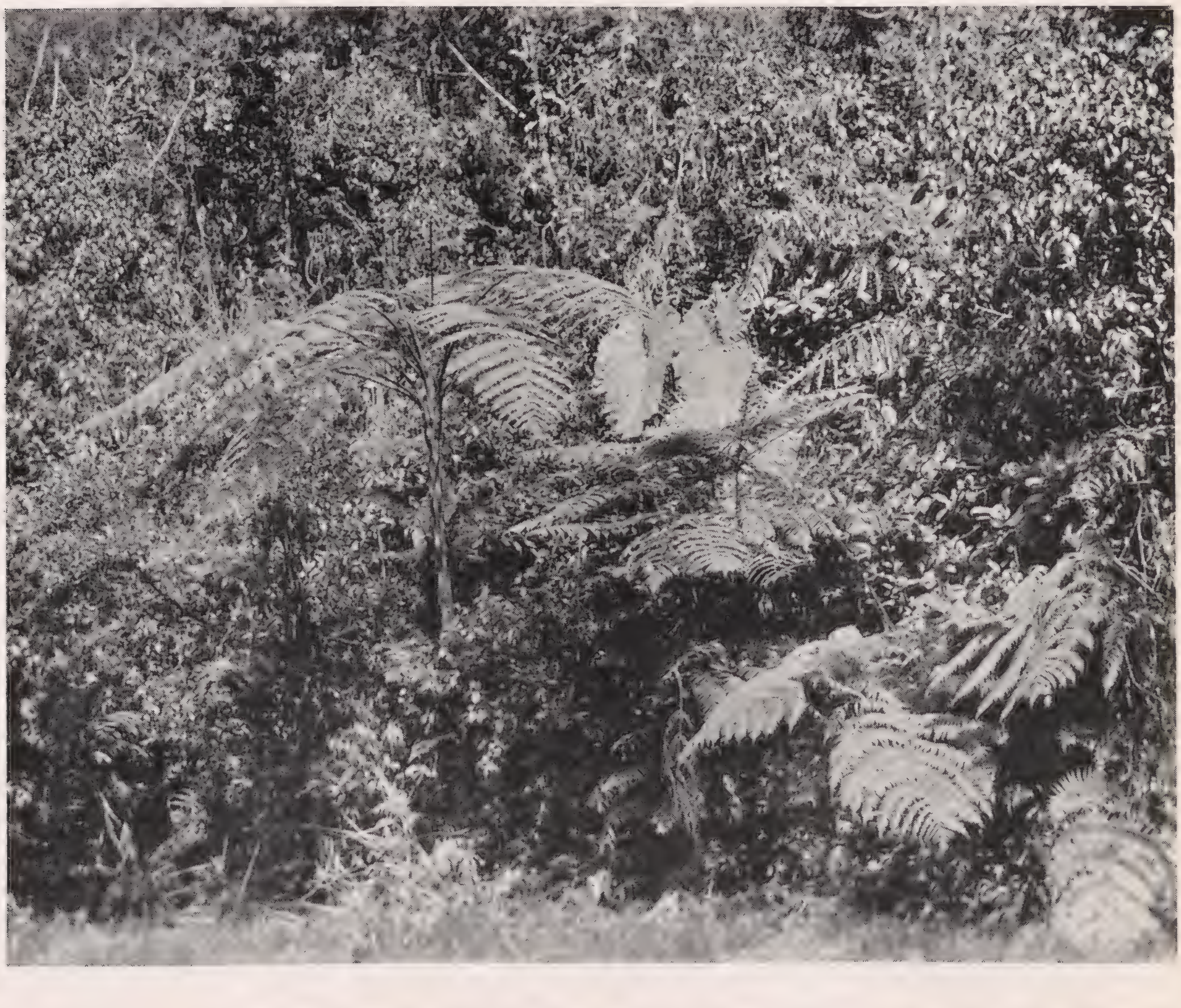
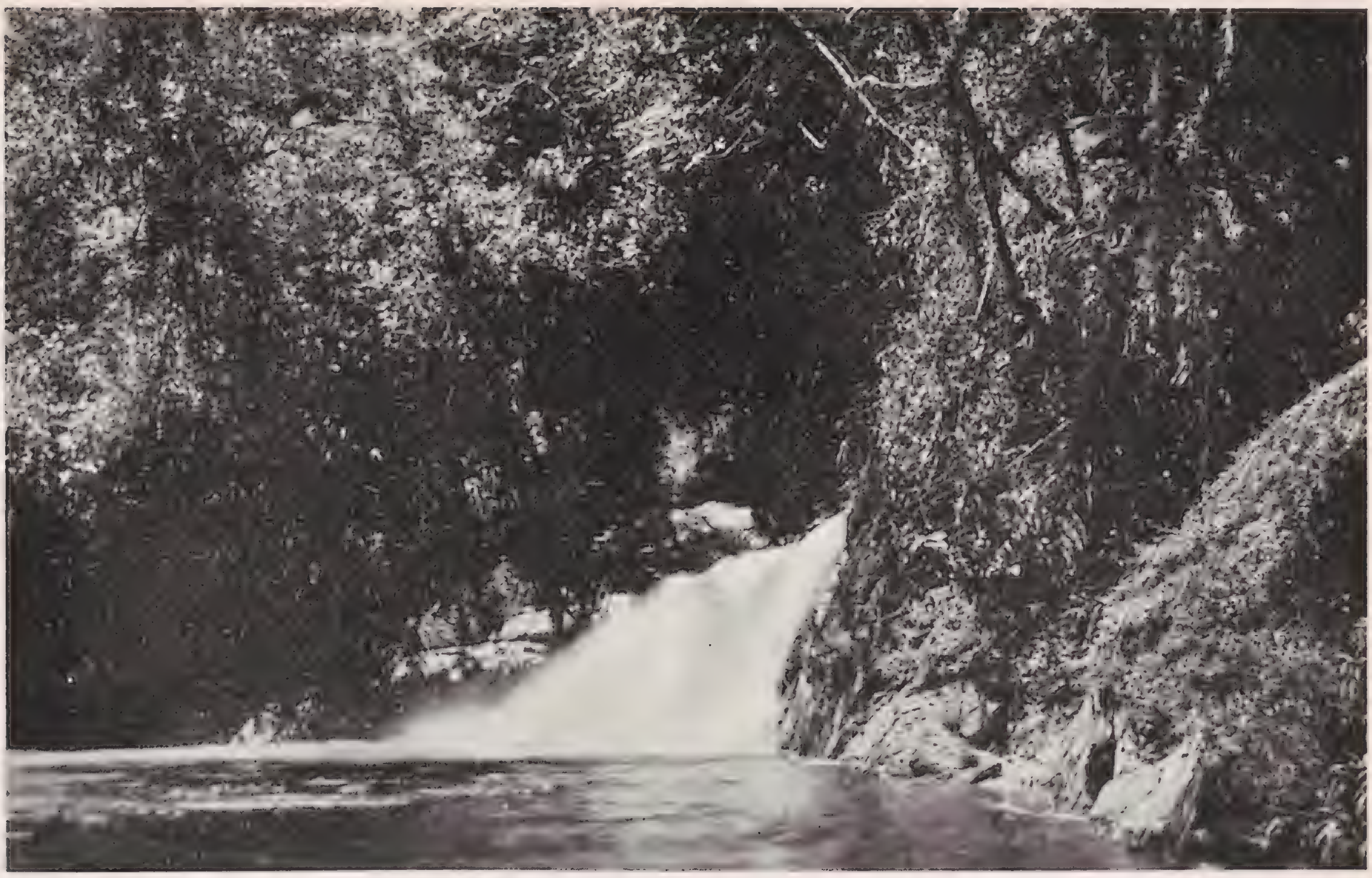
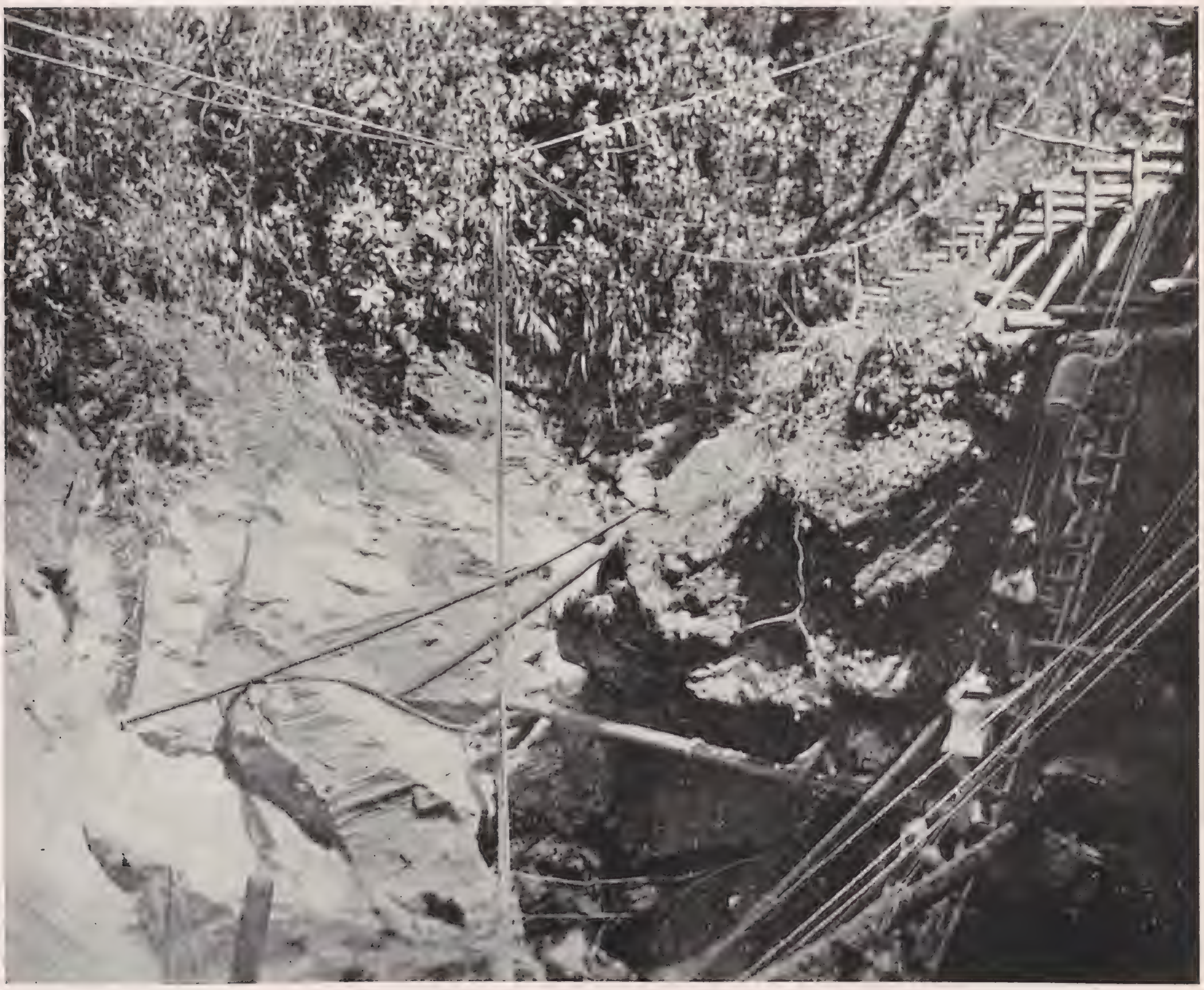

2

Fig. 1. Luxuriant vegetation in the Santa Rita Valley, the type locality of *Cerathyla johnsoni* sp. nov. Photographed by R. D. O. Johnson.

Fig. 2. The jungle viewed from the Santa Rita Creek, near spot where one specimen of *Cerathyla johnsoni* sp. nov. was collected. Photographed by R. D. O. Johnson.



1



2

Fig. 1. Santa Rita Creek, showing the habitat of *Hyloscirtus fuhrmanni* (Peracca). Photographed by R. D. O. Johnson.

Fig. 2. Bed of Santa Rita Creek. *Hyloscirtus fuhrmanni* (Peracca) was taken in the "capote" shown in the upper left hand corner of the picture. Photographed by R. D. O. Johnson.

56.81,9D : 14.71,7

Article XXXI.—THE FORE AND HIND LIMBS OF *DIPLODOCUS*.

By Charles C. Mook.

Although a considerable amount of material belonging to the sauropod dinosaur *Diplodocus* has been described, none of these descriptions has included a discussion of fore and hind limbs belonging to one individual. The material herein described was found by Mr. Barnum Brown of the American Museum of Natural History, in the Field Expedition of 1903, at Horse Coulé, 30 miles east of Pryor, Montana. The field relations of the bones, according to Mr. Brown, indicated clearly that they belonged to one individual. This material consists of a partially complete right scapula, and a nearly perfect left scapula and coracoid, right and left humeri, right and left radii and ulnæ, the distal half of the right femur and complete left femur, right and left tibiæ, fibulæ, and astragali, and a fragmentary pelvic bone. The bones together constitute No. 5855 of the American Museum Collection of Fossil Reptiles. These remains were studied by the writer for Professor Henry Fairfield Osborn in connection with the work on the monograph on the Sauropoda now in course of preparation for the United States Geological Survey.

The material under discussion was first identified as *Morosaurus*, but it now appears that this identification was incorrect and that the bones belong to *Diplodocus*. The reasons for the latter identification are as follows: 1st, the bones are practically all slender. In *Camarasaurus* (*Morosaurus*) the limbs, especially the hind limbs, are massive in form; 2d, the longitudinal axis of the scapula and the axis of greatest breadth make a very oblique angle with each other. This is also true of several scapulæ which are associated with undoubted *Diplodocus* vertebræ (Amer. Mus. No. 221, Carn. Mus. No. 94). The scapula of *Camarasaurus* (*Morosaurus*) has these two axes almost perpendicular with each other. 3d, the scapula is only moderately expanded at both superior and inferior ends; 4th, the ulna is not twisted in the manner characteristic of *Camarasaurus* (*Morosaurus*). The foregoing characters indicate *Diplodocus* as the correct identification for the material under consideration.

This material is of especial interest because it affords opportunity for the use of ratios between the various components of the fore and hind limbs. The scapula and coracoid are fused with each other, though the fusion is not complete in the region of the glenoid; the superior border is not complete in either specimen, but was evidently only slightly expanded. The shaft is short on its anterior border and of moderate length on its posterior side.

The inferior expansion is not very pronounced in either direction; in the posterior direction it is especially short. The anterior part of the inferior expansion extends for a considerable distance in a superior direction. This makes the axis of greatest breadth (from the posterior border of the glenoid to the superior point of the antero-inferior expansion) form a very oblique angle with the longitudinal axis. The glenoid surface of the scapula is short. The coracoid is subcircular rather than subquadrilateral. Its fore-and-aft diameter is greater than its vertical height. The coracoid foramen is situated very close to the coraco-scapular border.

Measurements, left scapula and coracoid.

1.	Total length of scapula and coracoid (not quite complete)	92.5 cm.
2.	Breadth across oblique axis	44.0
3.	Antero-posterior diameter of coracoid	26.0
4.	Vertical diameter of coracoid, estimated	21.0
5.	Length of glenoid surface	20.0
6.	Breadth of shaft	14.0
7.	Breadth of superior end (incomplete)	23.5

The humerus is very short in proportion to the length of the scapula and of the femur. It is comparatively slender and has a prominent deltoid crest. The crest extends inward, over the antero-superior fossa to a considerable extent, giving the humerus a twisted appearance. In the left specimen this effect has been increased by crushing. There is a prominent, though small, process on the center of the superior border; this process evidently articulated with the glenoid, and it indicates that the humerus was usually held in a highly inclined position. The shaft is comparatively long and slender. The distal end is expanded, the axis of expansion being somewhat oblique to the broad axis of the superior end. On the center of the antero-inferior border is a pair of small processes which assisted in supporting the radius and ulna when the humerus was greatly inclined. The prominence of these processes favors the idea of the humerus being customarily placed in an oblique position. The distal end is thick.

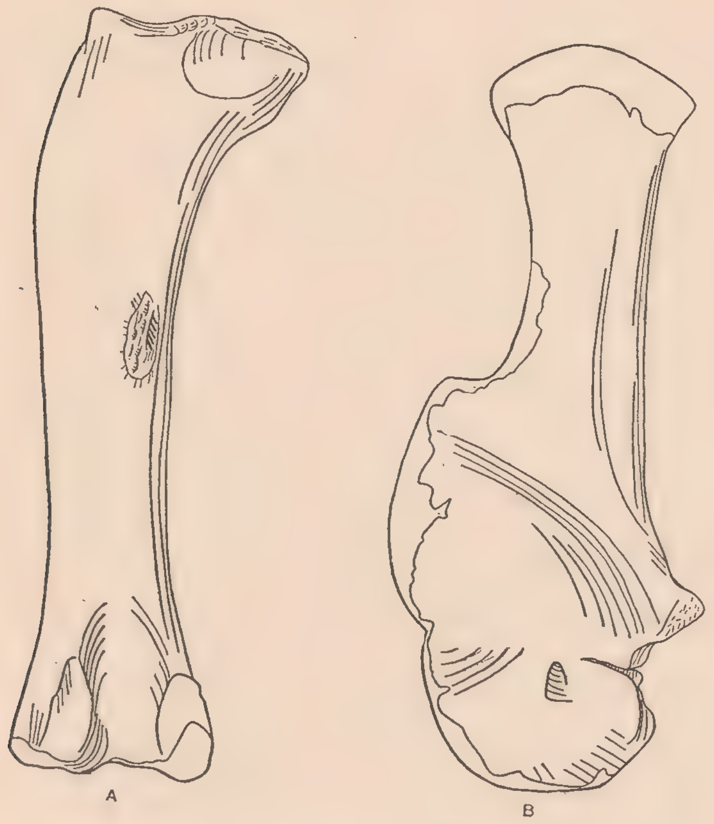


Fig. 1. Scapula, coracoid, and femur of *Diplodocus* (Amer. Mus. No. 5855), one-twentieth natural size. A, left femur, posterior view. B, left scapula and coracoid, external view.

Measurements of left humerus.

1.	Length, total	75.0 cm.
2.	Breadth, proximal end; estimated	28.5
3.	Breadth, distal end	21.5
4.	Distance from middle of proximal border to distal end of deltoid crest	35.0
5.	Distance from distal end of deltoid crest to center of distal border of humerus	41.0
6.	Ratio of 5 to 4	.853
7.	Circumference	32.0
8.	Index	.426

The radius and ulna are very small in comparison to the size of the humerus. The ulna has a shallow excavation on the superior portion of the anterior surface, which lodged the proximal end of the radius. The proximal end of the ulna is triangular in outline. The largest surface is the internal one, which is concave. The external one is flat. All three surfaces decrease in size toward the distal end, and their intersections become more or less obliterated, the outline of the distal end being subovate. On the antero-internal border is a slight depression which lodged the distal end of the radius. The radius is slightly flattened at the proximal end, the greatest diameter being the right and left. The shaft is slender, is broader than deep, and is slightly curved. The distal end is expanded and subcircular in outline.

Measurements, index, and ratios, left ulna.

1.	Length, total	54.5 cm.
2.	Greatest diameter, proximal end	14.5
3.	Greatest diameter, distal end	10.0
4.	Circumference	19.5
5.	Index	.357
6.	Ratio of length of humerus to length of ulna	.726
7.	Ratio of length of tibia to length of ulna	.949

Measurements, index, and ratios, left radius.

1.	Length, total	52.5 cm.
2.	Greatest diameter, proximal end	10.5
3.	Greatest diameter, distal end	11.5
4.	Circumference	19.5
5.	Index	.371
6.	Ratio of length of humerus to length of radius	.700
7.	Ratio of length of fibula to length of radius	.660

The femur is long and slender. The head is comparatively small, and is pointed. The great trochanter is set off rather sharply from the main body of the femur. The fourth trochanter is comparatively near the proximal end. The shaft, below the fourth trochanter, is slender. Both fibular and tibial condyles are large, especially the latter. The intercondylar grove is deep. A corresponding groove on the anterior surface of the distal portion of the femur is also deep. This groove evidently lodged a large tendon or muscle.

Measurements, index, and ratios of left femur.

1.	Length, total	113.5 cm.
2.	Breadth, proximal end	31.5
3.	Breadth, distal end	28.5
4.	Length from center of proximal border to center of fourth trochanter	50.0
5.	Length from center of fourth trochanter to center of distal border	60.5
6.	Ratio of 5 to 4	.826
7.	Circumference	40.5
8.	Index	.356
9.	Ratio of length of femur to length of humerus	.660
10.	Ratio of length of femur to length of tibia	.696
11.	Ratio of length of femur to length of fibula	.700

The tibia is much smaller than the femur. It is slender. The proximal end is round and not flat as many sauropod tibiæ are known to be. This may be largely due to absence of crushing. The fibular ridge on the supero-external surface is small. The shaft is slender. The distal end has a cavity which lodged the ascending process of the astragalus. The internal border extends slightly below the external border. The distal end is expanded, the expansion assisting in locking the distal end of the fibula in place.

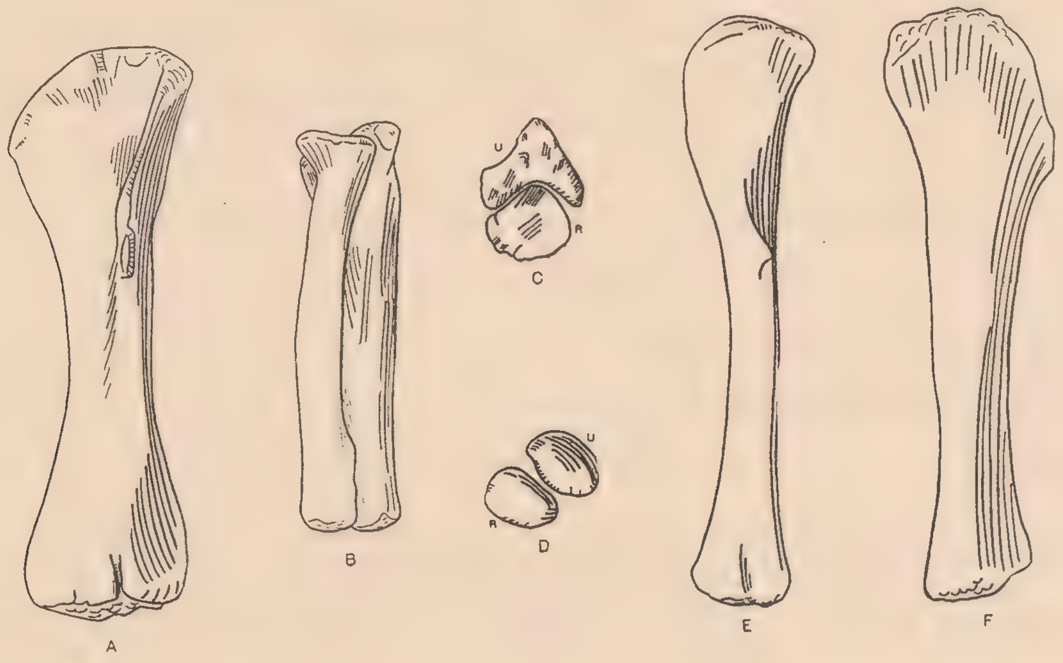


Fig. 2. Limb bones of *Diplodocus* (Amer. Mus. No. 5855), one-twentieth natural size. A, left humerus, anterior view. B, left radius and ulna, anterior view. C, left radius and ulna, proximal view. D, left radius and ulna, distal view. E, left fibula, external view. F, left tibia, anterior view. R, radius; U, ulna.

The fibula is long and slender. It is quite deep antero-posteriorly at the proximal end and narrows gradually to a point near the distal end, from which it rapidly expands again. Laterally the fibula is exceedingly slender. There is a prominent rugosity, which formed the attachment for a prominent muscle, somewhat above the middle of the shaft on the external surface. This rugosity is situated on a ridge which merges distally into the posterior surface of the bone.

Measurements, index, and ratios of left tibia.

1.	Length, total	79.0 cm.
2.	Greatest diameter, proximal end, including fibular ridge	24.5
3.	Greatest diameter, distal end	18.0
4.	Circumference	27.5
5.	Index	.348
6.	Ratios (see measurements of ulna and femur).	

Measurements, index, and ratios of left fibula.

1.	Length, total	79.5 cm.
2.	Greatest diameter, proximal end	18.0
3.	Greatest diameter, distal end	13.0
4.	Distance from center of proximal border to center of external rugosity	33.5
5.	Distance from center of external rugosity to center of distal border	45.5
6.	Ratio of 5 to 4	.736
7.	Thickness of shaft, laterally, a short distance above distal end	3.3
8.	Ratios (see measurements of radius and femur).	
9.	Circumference	17.5
10.	Index	.220

The interest in this material lies, of course, in the reliable manner in which the relative proportions of the various elements of the fore and hind limbs may be ascertained. The humerus is slightly less than two-thirds as long as the femur, while the tibia and fibula are about seven tenths as long as the femur. These proportions may be of use in determining the size of individuals of *Diplodocus* from incomplete skeletons.

The accompanying outlines indicate the above-mentioned proportions graphically. The material will be fully illustrated in the Sauropoda Monograph.

56.9(1181:78.9).

Article XXXII.— NOTES ON PALEOCENE AND LOWER EOCENE MAMMAL HORIZONS OF NORTHERN NEW MEXICO AND SOUTHERN COLORADO.

By Walter Granger.

Plates XCVII and XCVIII.

The purpose of the present short paper is to indicate some of the results of the Eocene exploration conducted by the writer, with the assistance of Mr. George Olsen, in the San Juan Basin in 1916. It is hoped that the following notes may be of some aid to future Eocene collecting in this region and possibly also to detailed geologic plotting.

Three separate localities were examined, viz.: the Torrejon of Angel Peak, lying south of the San Juan River; the Torrejon of the Animas Valley, between Aztec and Cedar Hill; a set of later beds in Colorado, lying north of the Denver and Rio Grande Railway, between Los Piños and Piedra Rivers.

The American Museum expedition of 1913 visited nearly all of the Paleocene localities of the San Juan Basin from which fossils had previously been obtained, made extensive collections and summarized the stratigraphic results in a paper published the following year.[1]

These localities are all on the south side of the San Juan River and extend in a long line from the vicinity of Ojo Alamo eastward to the Puerco River below Cuba. Exposures lying to the north near the San Juan and in the Animas Valley were known to be Paleocene but for lack of time were not examined that year.

The Angel Peak Region.

The exposures at Angel Peak are in the form of a gigantic crater cut out of a fairly level grass-covered plain to a depth of several hundred feet and with a diameter of three to four miles. Angel Peak itself, which is merely an irregular-shaped residual mass of Eocene shales and sandstones, rises from the eastern wall of this crater. The drainage of this great badland basin is northward into the San Juan through a rough steep-walled valley known as Coots Cañon. The region was worked from a spring on the rim on Sec. 3, T. 27 N., R. 11 W. The beds present a generally grayish appearance with occasional reddish bands, not unlike Puerco and Torrejon exposures further to the south. They are mostly shales with some heavy layers of sandstones which, toward the center of the basin, have assisted in the formation of low mesas. Because of limited time and the great extent and extreme roughness of the exposures in this basin not more than half the area was examined but Torrejon fossils were found in fair abundance although in an unusually poor state of preservation. The characteristic fossil levels of the typical Torrejon were absent and the bones were found on various horizons from near the base of the beds in the center of the basin to within 150 feet of the top along the western wall. Some of the localities as noted on field labels are: "1 mile west of Angel Peak," "2 miles west of Angel Peak", and "Sec. 26, T. 27 N., R. 11 W." (along western rim). Further to the north at the head of a deep draw which puts into Coots Cañon from the west some better preserved fossils were found on Sec. 3, T. 27 N., R. 11 W. Among the specimens obtained from these various localities are the following:

---

[1] Sinclair, W. J., and Granger, Walter, 'Paleocene Deposits of the San Juan Basin, N. Mex.' Bull. Amer. Mus. Nat. Hist., Vol. XXXIII, pp. 297–316, 1914.

Tetraclænodon
Mioclænus turgidus
Periptychus rhabdodon
Anisonchus sectorius
Protogonodon sp. nov.
Tricentes
Deltatherium
Psittacotherium

These, with one exception, are characteristic Torrejon forms. *Protogonodon* is a Puerco genus, not previously known from the Torrejon, but the present specimen is not of a Puerco species and shows the advancement of tooth structure to be expected in the transition from the lower to the upper horizon. Without question, then, the lower two-thirds of the exposures of the Angel Peak basin is Torrejon formation. The uppermost 100 to 150 feet, although unfossiliferous where examined, may also be Torrejon but the beds have much the appearance of the upper beds of the Ojo Alamo section, which are soft yellowish sandstones referred to the Wasatch. The exposures for three miles down Coots Cañon were examined and found barren. These beds are lower than any exposed in the basin and take on more the appearance of the Puerco of Ojo Alamo. The writer is of the opinion that they are Puerco from the fact that they underlie beds of known Torrejon age and are above the Cretaceous. If they are Torrejon it would make a much greater thickness for that formation in this locality than it has anywhere to the southward. No unconformities were observed either above or below the fossiliferous zone.

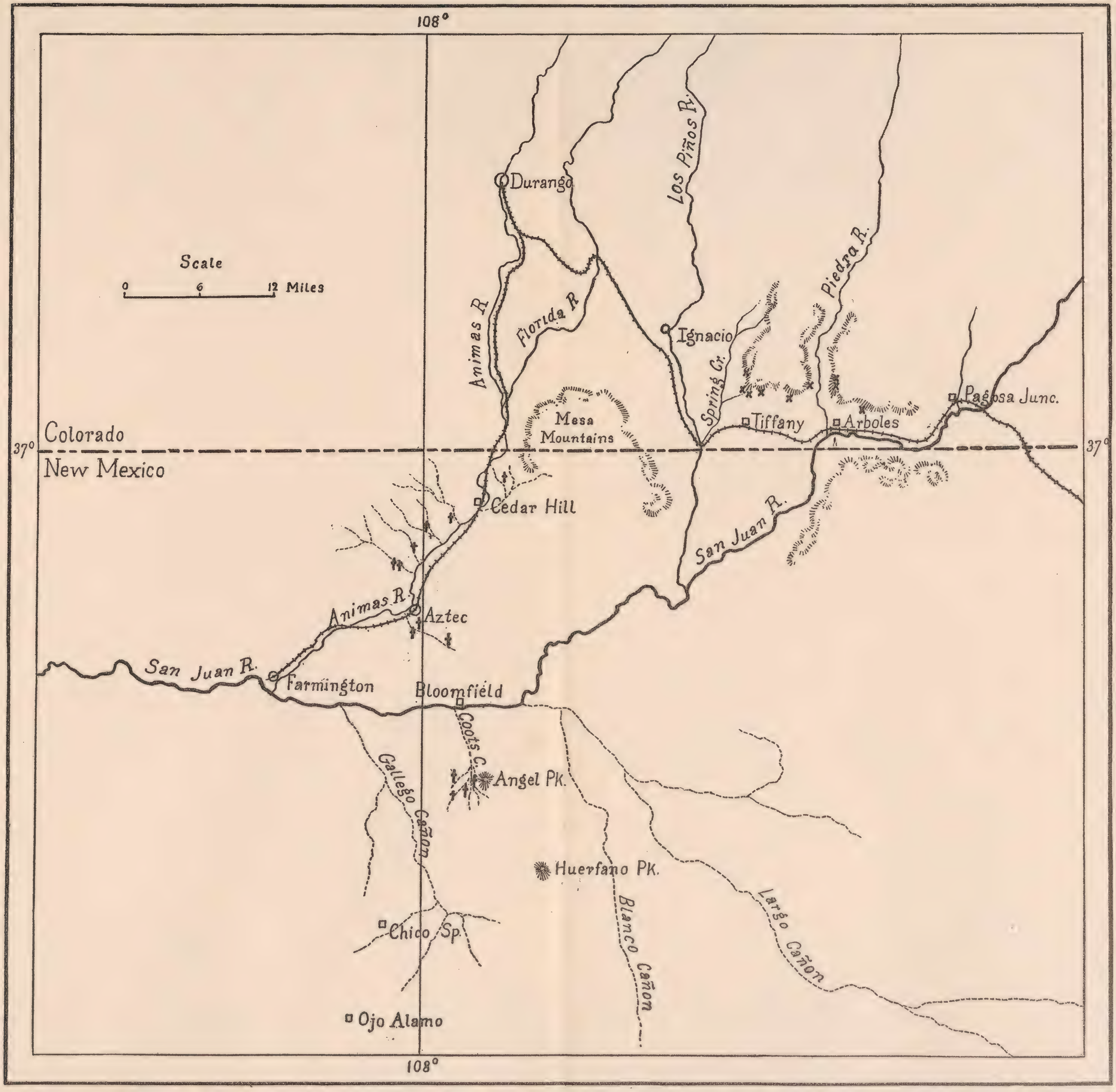


Fig. 1. Sketch Map of a portion of the San Juan Basin showing sections examined in 1916. † indicates localities from which Torrejon fossils were obtained, × those in which Tiffany beds fossils were found.

The Lower Animas Valley.

At the mouth of the Animas River the surface rocks are of Cretaceous age. The great bluff of the San Juan River opposite Farmington is, according to C. M. Bauer,[1] made up chiefly of the Kirtland shale with the contained Farmington sandstone member, the bluff being capped by sandstones and shales referred to the Wasatch.

On the geologic map of the paper cited (pl. lxiv) Bauer has indicated the rocks of the south side of the San Juan for two or three miles below the mouth of Gallego Cañon and an equal distance above it as being Wasatch, apparently a continuation of the rocks capping the bluff opposite Farmington. Although the writer has never examined the beds along the San Juan at this point he is inclined to believe from their appearance and from a knowledge of the beds to the north and east that the lowermost of them, at least, are Paleocene. David Baldwin probably prospected this section in the early eighties and although he did not record anything from the mouth of Gallego he did obtain Torrejon fossils from further up the San Juan as well as from the Animas Valley to the north. Such records of Baldwin's as there are of fossils from the northern exposures of the Paleocene are as follows:

Neoplagiaulax molestus. Type.	"North side San Juan River", 1886.
Mioclænus turgidus (3159)	"Rio San Juan."
" *opisthacus.* Type.	"Rio San Juan", 1882.
Deltatherium fundaminis. Type.	"Mouth of Canon Largo."
Hemithlæus baldwini. Type.	"Rio San Juan."
Periptychus carinidens. Type.	"Mouth of Cañon Largo."
" *rhabdodon* var. *fissus* (362a)	"S. side San Juan River."
Pantolambda cavirictus. Type.	"Ute Reserve near Durango, N. M.", 1883.
"Various Teeth."	"N. side San Juan on Animas."
Humerus	"West side Animas."

These are all Torrejon forms. The specimens from the mouth of Largo Cañon are spoken of as coming from "below the Cañon Largo sandstones" (?basal Wasatch ss.) and judging from Baldwin's letters were from near the base of the exposures. The type of *Pantolambda cavirictus* is probably from the Animas Valley, near the Colorado-New Mexico line. The other localities given are too indefinite to be of much value.

The examination of the Animas Valley last season was begun about a mile below Aztec on the east side of the valley. In travelling up the Animas from Farmington one gradually passes out of the Cretaceous and near

---

[1] Bauer, Clyde Max, 'Stratigraphy of a part of the Chaco River Valley,' U. S. G. S. Prof. Paper 98–P., pp. 271–278, 1916.

Aztec the first good exposures of the overlying Paleocene shales are seen. The first fossils were obtained from the long draw through which the Aztec-Bloomfield road passes, at a point a few hundred yards south of the forks of the road and about one and one-half miles south of the Aztec station. A section taken at this point is as follows:

Soft buff-colored sandstones	43 feet
Deep weathering, olive-colored shales	22
White sandstones, buff in places and with brown nodules	25
Olive-colored shales with numerous brown nodular masses (mammals from upper part)	60+
	150+

The following Torrejon mammals were obtained from the lower element of this section: Plagiaulacid (*?Ptilodus*), *Clænodon, Tetraclænodon, Tricentes, ?Protoselene,* indet. Oxyclænid. From the head of this same draw at a somewhat higher level and from a local reddish stratum similar in appearance to the fossiliferous layers of the typical Torrejon were obtained jaws of *Periptychus rhabdodon* and *Deltatherium fundaminis.* Other exposures both to north and south of this draw failed to yield fossils.

The most extensive exposures of the lower Animas Valley are to be found on the west side from about three miles north of Aztec northward to Cedar Hill. Several great draws coming down from the high divide between the Animas and La Plata Rivers put into the Animas here and the sides are weathered out into unusually rough badlands. These draws, beginning with the southernmost, are called Bohannan, Tucker, Kiffin and Leper Cañons. The beds exposed here are grayish shales and buff sandstones which to the northward, especially in Leper Cañon, alternate with strata of red and purplish shales. On the upper levels the sandstone layers become thicker and near the top of the divide they predominate over the shales. A total thickness of not less than 1000 feet is represented here. The upper levels, which are presumably Wasatch, were examined in several places but found barren of fossils. In the lower gray shales, however, a small collection of rather poorly preserved Torrejon mammals was secured. Fossils were found in each of the draws and were not confined to distinct horizons although always in the gray shales and limited in each case to the lower 300 feet of the exposures. One small "pocket" on the south side of Bohannan Draw, about one and one-half miles above its mouth, was fairly rich and furnished about one-half of all the material collected in this section. Among the forms obtained from this area along the west side of the Animas are the following:

Periptychus rhabdodon
Mioclænus turgidus
Tetraclænodon
Mixodectes
Pentacodon
Tricentes
Didymictis haydenianus
Clænodon
Deltatherium

The last set of exposures of the Animas Valley to be examined lay on the east side of the river near Cedar Hill. Here near the head of a long draw which puts into the Animas at the Cedar Hill bridge were obtained a fragmentary skull of *Pantolambda cavirictis* and a jaw of *Tetraclænodon.* These were from an elevation of between 200 and 300 feet above the river and apparently from a higher level than any of the fossils found further down the valley. Above Cedar Hill the valley narrows up rather abruptly and although there are small exposures of the lower levels here and there they were not examined.

It is evident from the collection made that the lower 300 feet of the beds exposed along the Animas from Aztec to Cedar Hill belong to the Torrejon formation. Lithologically these beds are not dissimilar to the Torrejon of the southern area, although the two sharply defined horizons of the type locality are missing on the Animas. At Aztec the country is low and the beds apparently do not reach above the Torrejon, but at Cedar Hill and along the heads of the big draws on the west side of the river between Aztec and Cedar Hill the passage up into the Wasatch is undoubtedly made but the line of contact was not determined.

While the Animas fauna is distinctly Torrejon it is difficult to correlate it with that of either the upper or lower horizons of the typical Torrejon. There is, in fact, no very great distinction, so far as known at present, between the two horizons, nor could any great difference be expected since the two levels are separated by only 100 feet of supposedly continuous sedimentation. *Deltatherium* is confined to the lower level where it is common. *Pantolambda* seems to occur only on the upper level and certain species common to both horizons are relatively much more abundant in one than in the other. For instance *Mioclænus turgidus* is rare in the upper level while in the lower it is about the most common form. On the whole it may be said that, aside from the Cedar Hill specimens, the Animas fauna is rather closer to that of the lower horizon of the type locality. The *Pantolambda cavirictis,* from Cedar Hill, is distinctly an upper beds form and it seems probable that the entire vertical range of the Torrejon formation is represented here.

Whether or not the Puerco underlies the Torrejon along the Animas the writer is not able to say. At Aztec there are at least 100 feet of Paleocene shales and soft sandstones underlying the lowest stratum in which Torrejon fossils were found, and these may belong to the Puerco. Above Cedar Hill, near the mouth of the Florida River, the beds, which are nearly horizontal further south, are slightly uptilted and levels apparently lower than any exposed between Aztec and Cedar Hill are brought to the surface. These are alternating sandstones and light gray shales. One of the best exposures of these lower beds was observed along the bank of the Florida about two miles above its mouth but no fossils were found in it; these also may be Puerco but in the absence of fossils it could not be determined definitely. The valley of the Animas above the Florida was not visited and the contact between the Paleocene and the Animas formation was not noted.

The Ignacio Region.

Along the eastern border of the Ignacio quadrangle in southern Colorado there arises abruptly to a height of over 2000 feet above the broad valley of Los Piños River a great mass of Tertiary sediment. This formation is continued to the eastward to within a few miles of Pagosa Junction where the sharply upturned edges are seen resting on the Cretaceous. To the north it reaches nearly to the State highway between Bayfield and Pagosa Springs. It is the northern edge of the great area of Lower Eocene which extends southward to the Nacimiento Mountains and the heads of the Puerco and Chaco tributaries, Torrejon, Escavada and other arroyos. It is deeply dissected by the Piedra and San Juan Rivers and is separated from the Mesa Mountains to the southwest by a great stretch of open country drained by Los Piños River. The area near Ignacio has been studied and measured for the Government Survey by J. H. Gardner and his section taken there has been published by W. T. Lee.[1] The beds are referred by Gardner to the Wasatch and his section shows a total thickness of 2275 feet of reddish, brownish, yellowish, tan-colored, purplish and gray shales and gray and tan-colored sandstones. The shales are predominant in the lower part of the section, the sandstones becoming more frequent and massive toward the top. The beds, in the Ignacio region, lie nearly horizontal; they overlap the Torrejon and Puerco and rest on the Animas formation, according to Gardner, with unconformity not perceptible. This sediment is pretty well masked by a dense growth of cedars, piñons, scrub-oak and pines but here and there are scars on the steep slopes where the surface seems to have slipped off leaving exposed the bright variegated shales which at a distance have a pale reddish effect. The largest of these exposures are perhaps half a square mile in area but most of them are of only a few acres. J. W. Gidley, of the National Museum, who accompanied Gardner when he made his studies (1909) succeeded in obtaining from the lower part of the beds a small but interesting mammalian fauna. While the upper part of the beds are, without much question, of the same age as the fossiliferous Wasatch of the Gallina region, 75 miles to the southeast, the lower beds containing the fauna discovered by Gidley cannot properly be correlated, on a faunal basis, with any part of the Gallina Wasatch.

---

[1] Lee, W. T. "Stratigraphy of the Coal Fields of Northern Central New Mexico." Bull. Geol. Soc. Amer., Vol. 23, p. 584, 1912.

A brief report by Mr. Gidley on this collection has recently been published.[1] In this he states that the fauna appears to be intermediate between the Fort Union and the Wasatch and lists the following forms: *Coryphodon* sp. indet., a phenacodont intermediate between *Phenacodus* and *Euprotogonia, Hemiacodon* (?sp. nov.), *Nothodectes* sp., miscellaneous teeth apparently belonging to species of the Clark Fork beds.

Three years ago when the writer was in the San Juan Basin Mr. Gidley kindly volunteered information regarding these mammal-bearing beds but lack of time prevented an examination of them that season. Last summer, however, the party spent nearly a month in a thorough prospecting of the horizon. Practically all of the exposures, from their western limit near Ignacio eastward to a point two or three miles east of the Piedra River, were gone over with great care and with the result that a small collection was secured which fully substantiates Gidley's contention that the fauna is intermediate between the Torrejon (Fort Union) and the Wasatch. The fossils were in every case from the lower beds, a vertical range of not over 300 feet, and, with one exception, were from the shales. A few of the specimens came from the Piedra Valley and several from directly north of Allison, but by far the richest locality was at the extreme western end of the hills on Sec. 20, T. 33 N., R. 6 W. This is the locality reported by Gidley as the one from which he got his collection. Even in the richest pockets, however, fossils were not abundant and it was only by going over the ground with the greatest care that the collection was secured. The material obtained may be divided into two classes: first, such specimens as were found isolated, in most cases already weathered out, and second, an aggregation of remains of small mammals found in a mass of soft uniform gray shale which was imbedded in a stratum of mottled purplish and brownish clay. This gray shale mass was irregular in shape and less than half a cubic yard in bulk, although probably considerably reduced by erosion, and having all the appearance of being the filling of a fissure formed in the mottled clay.

---

[1] Wegemann, Carrol H. "Wasatch Fossils in So-called Fort Union Beds of the Powder River Basin, Wyoming." U. S. G. S., Prof. Paper No. 108 D, pp. 57–60, 1917 (Report by J. W. Gidley on 59).

The material of the first group comprises the following forms:

Periptychus, sp. nov.	? *Chriacus*
Phenacodonts, 3 species	*Nothodectes* sp.
? *Dissacus*	

The *Periptychus* shows the reduced premolars of *P. carinidens* and the elongated molars of *P. rhabdodon.* The three species of phenacodonts are indicated by their size; the largest of these is unquestionably referable to the genus *Phenacodus* since all three upper molars possess well developed mesostyles. It is about as large as *P. intermedius.* The other two species are represented by lower teeth only and cannot be referred positively to either *Phenacodus* or *Tetraclænodon.* The smaller one is equal to *T. minor* in size and the other is intermediate between that and *T. puercensis.* A single premolar tooth is referred doubtfully to *Dissacus* but it cannot be distinguished from one of the smaller species of *Pachyæna.* A single worn upper molar agrees fairly well with *Chriacus.* *Nothodectes* is represented by an m_3 and fragments of jaws without teeth.

It is from the small gray shale "pocket" though that by far the most important material was obtained. There is here preserved, apparently, a fair representation of the small mammal fauna of that locality. The process of working out the extremely delicate material from the matrix, which was taken up in sections, has only begun but already several new and interesting forms have shown up. The first of these, a bat (*Zanycteris*) has already been described by Dr. W. D. Matthew and descriptions of the other forms will follow at intervals. Not only are fragmentary skulls and jaws preserved but there is a considerable amount of disorganized skeleton material, all in a fair state of preservation. The fossils are rather evenly distributed through the matrix and not confined to one level. The occurrence of so many small forms in this deposit and the absence of any of the larger ones suggests that they may be the remains of animals brought into a fissure by a small predatory mammal. The exact location of this deposit is in a small low-lying exposure of brownish and purplish shales of three or four acres in extent lying three-fourths of a mile northeast of the Mason schoolhouse on Sec. 20, T. 33 N., R. 6 W. (See Plate XCVIII.) The deposit will be referred to in future papers as the Mason quarry or Mason pocket.

Of the fauna of this Mason quarry *Nothodectes* seems to be the most common form and is represented by skeleton material as well as broken skulls and jaws. Besides this there is the bat *Zanycteris;* a tiny marsupial; small plagiaulacids of probably two genera; a genus possibly belonging to the Tarsiidæ; one or two genera of insectivores, and a few bird and lizard bones. Doubtless other things will come to light as the preparation work advances.

To those familiar with our Eocene mammalian faunas the position of this one as intermediate between the Torrejon and Wasatch[1] is manifest. *Periptychus* has not been found before above the Torrejon and *Phenacodus* has not been found as low as the Torrejon. *Chriacus,* a common Torrejon genus runs through to the Wasatch[2] and the same applies to *Dissacus. Coryphodon,* reported by Gidley, is a common Lower Eocene genus, rare in the Clark Fork and absent from the Torrejon. *Nothodectes* has been known only from the type which comes from the Clark Fork. Plagiaulacids are more suggestive of the Torrejon but one large form runs through to the base of the Wasatch (Sand Coulee beds). The "*Hemiacodon*" of Gidley's list would, the writer feels, in the presence of more complete material, prove to be something else since *Hemiacodon* is a Middle Eocene (Upper Bridger) genus.

The closest correlation of these beds seems to be with the Clark Fork beds of Wyoming. The predominance of phenacodonts, the presence of *Nothodectes* and the general intermingling of Paleocene and Lower Eocene genera are points of resemblance. The Clark Fork beds immediately underlie the lowest *Eohippus*-bearing levels of the Wasatch in the Bighorn Basin, and these Colorado beds seem to occupy about the same stratigraphic position. Although no fossils have been found in the overlying beds of the Ignacio region, yet the lower beds fauna is certainly older than the lower fossiliferous levels of the Gallina region which contain a typical Wasatch fauna.

This Colorado horizon should be specially designated and the writer suggests the name **Tiffany Beds**, after the station of Tiffany on the Denver and Rio Grande Railway, four miles south of the Mason schoolhouse. Possibly the vertical range of the fauna characterizing these beds is greater than 300 feet but the formation is not cut through to its base at the Mason schoolhouse or at any other points where fossils were found, and the levels above 300 feet, probably because of the precipitous nature of the exposures, have not yielded fossils.

The question arises as to whether these Tiffany beds and the apparently equivalent Clark Fork beds of Wyoming are to be considered as Paleocene or Lower Eocene. Dr. Matthew is inclined, on the basis of fauna only, to consider them as the top of the Paleocene while the writer at present feels that they may more consistently be placed as the base of the Lower Eocene. The Tiffany beds have been treated in Gardner's section as a part of a stratigraphic unit referred to the Wasatch and hence are to be considered as Lower Eocene. The writer is not able to differentiate these beds, stratigraphically from the overlying beds, yet the fact remains that the fauna is distinctly more primitive than that which is commonly known as Wasatch and, considering both those forms which are present and those which are conspicuous by absence, it actually resembles the Torrejon more than the Wasatch.

---

[1] The term "Wasatch" is here used in the generally accepted palæontological sense, comprising such beds as contain *Eohippus* and its associated forms, which include lemuroids, rodents and artiodactyls.

[2] Found in the Gallina district only.

In the Bighorn basin the sequence of Eocene beds is as follows:

Lost Cabin
Lysite[1]
Gray Bull
Sand Coulee
Clark Fork

No certain stratigraphic unconformity has been detected in this Wyoming series but a big faunal break occurs between the Clark Fork and the Sand Coulee beds. Four modern orders of mammals — Primates, Perissodactyls, Artiodactyls and Rodents — which are absent in the Clark Fork make a sudden appearance as common fossils in the Sand Coulee beds. These four orders[2] are also unrepresented in the Tiffany beds and yet they are common on the lowest fossil levels of the Gallina Wasatch and would also very probably be found in the middle and upper levels of the series in the Ignacio region if the beds there were more advantageously exposed.

It would be easier to explain this sudden advent of entirely new types of mammals if unconformities were found above the Clark Fork and above the Tiffany beds. Sinclair and Granger have noted a probable unconformity[3] on the western side of McCulloch Peak, in the Bighorn, immediately above beds similar in appearance to the typical Clark Fork. In the Clark Fork basin no unconformity has been detected although, because of changes in the fauna, its existence has been suspected. Similarly one might expect a stratigraphic break above the Tiffany beds. Should the existence of such unconformities ever be established this would seem to the writer to be the place to draw the line between the Lower Eocene and the Paleocene.

---

[1] The Knight formation of the type locality of the Wasatch appears to be the equivalent of the Lysite or the upper Gray Bull.

[2] The Primates are included on the assumption that *Nothodectes* and a peculiar form suggesting some of the Tarsiidæ are not actually referable to this order.

[3] Bull. Amer. Mus. Nat. Hist., Vol. XXXI, Art. V, p. 59, 1912.

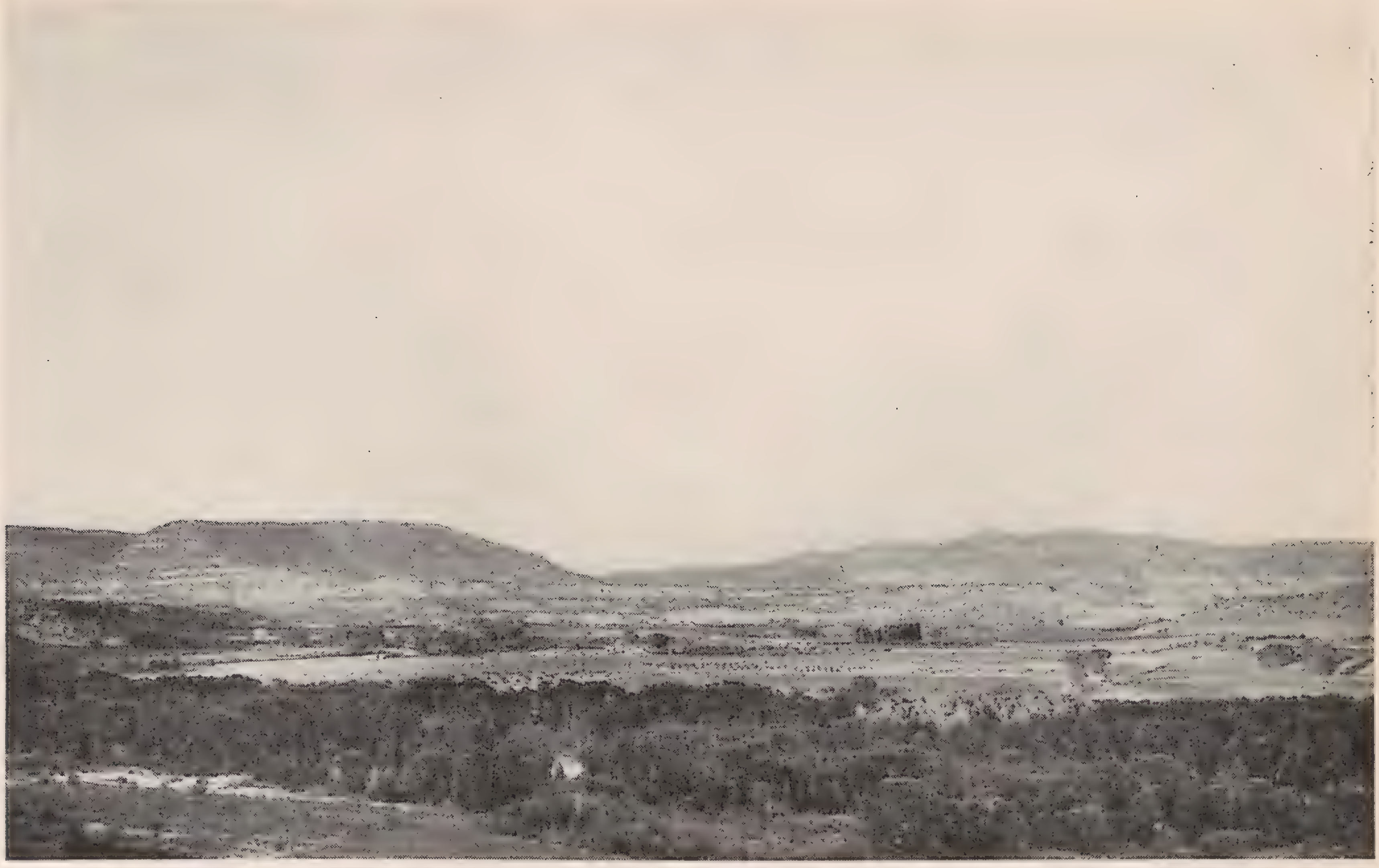


Fig. 1. Looking eastward across the Animas Valley at Cedar Hill. The Mesa Mountains, in the background, show exposures of Torrejon at their base.

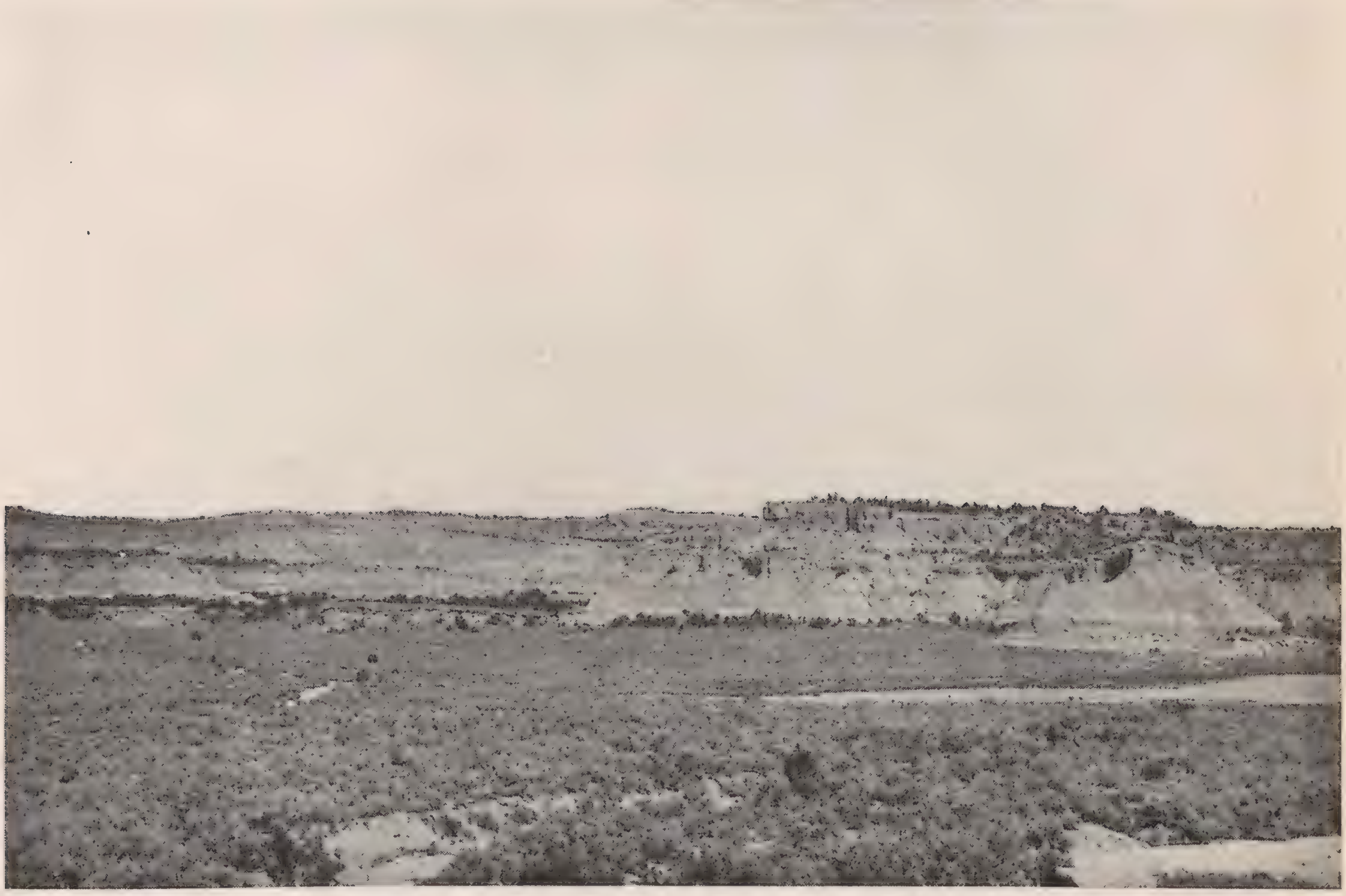


Fig. 2. Torrejon beds at mouth of Leper Cañon, west side of the Animas Valley just below Cedar Hill. The sandstones of the upper levels in the background are probably Wasatch.

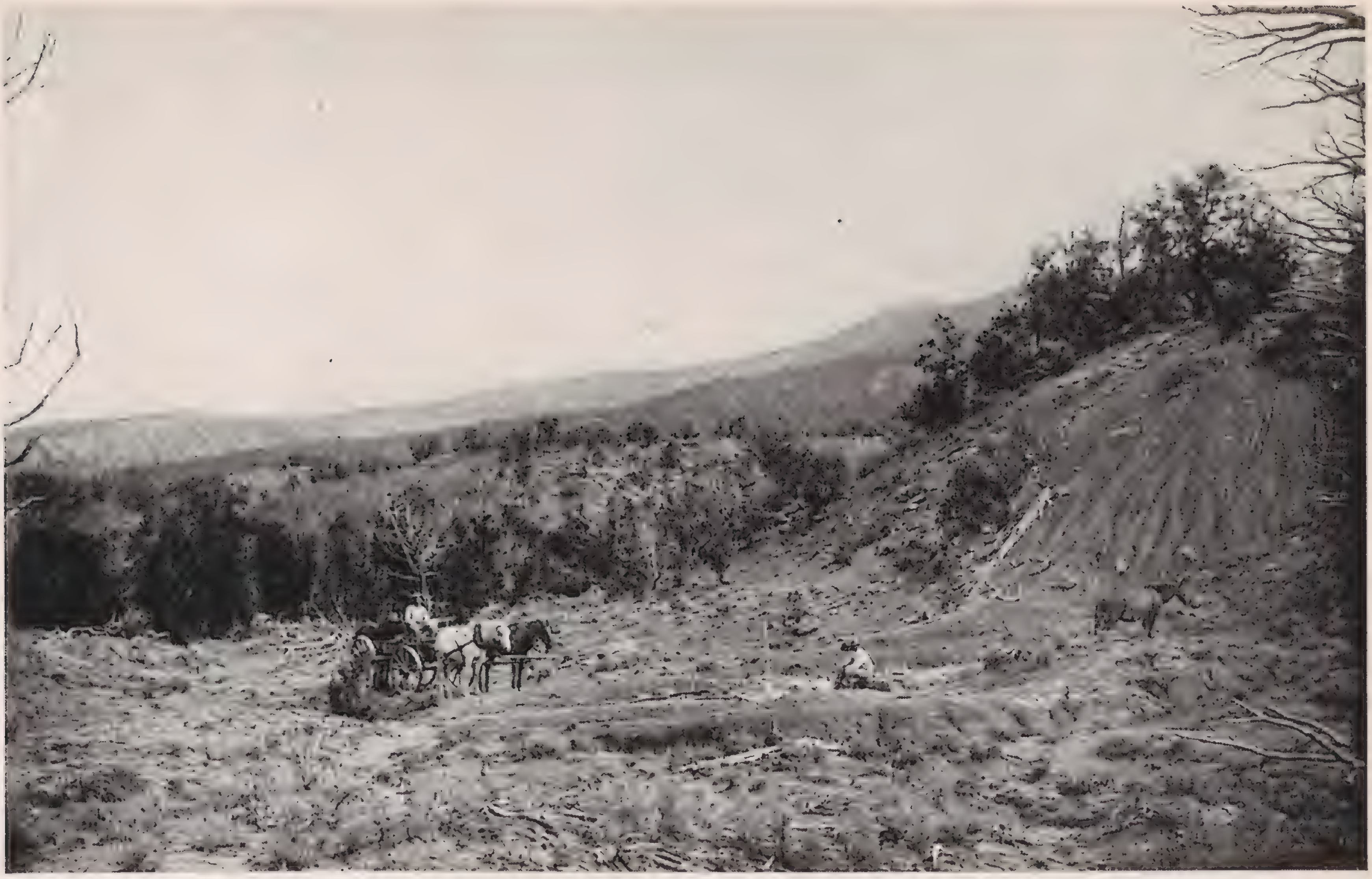


Fig. 1. Small exposure of the Tiffany beds about three-fourths of a mile northeast of the Mason schoolhouse, Sec. 20. T. 33 N., R. 6 W., Colorado, looking northeast. Man is seated on the edge of the excavation from which small mammals were obtained.

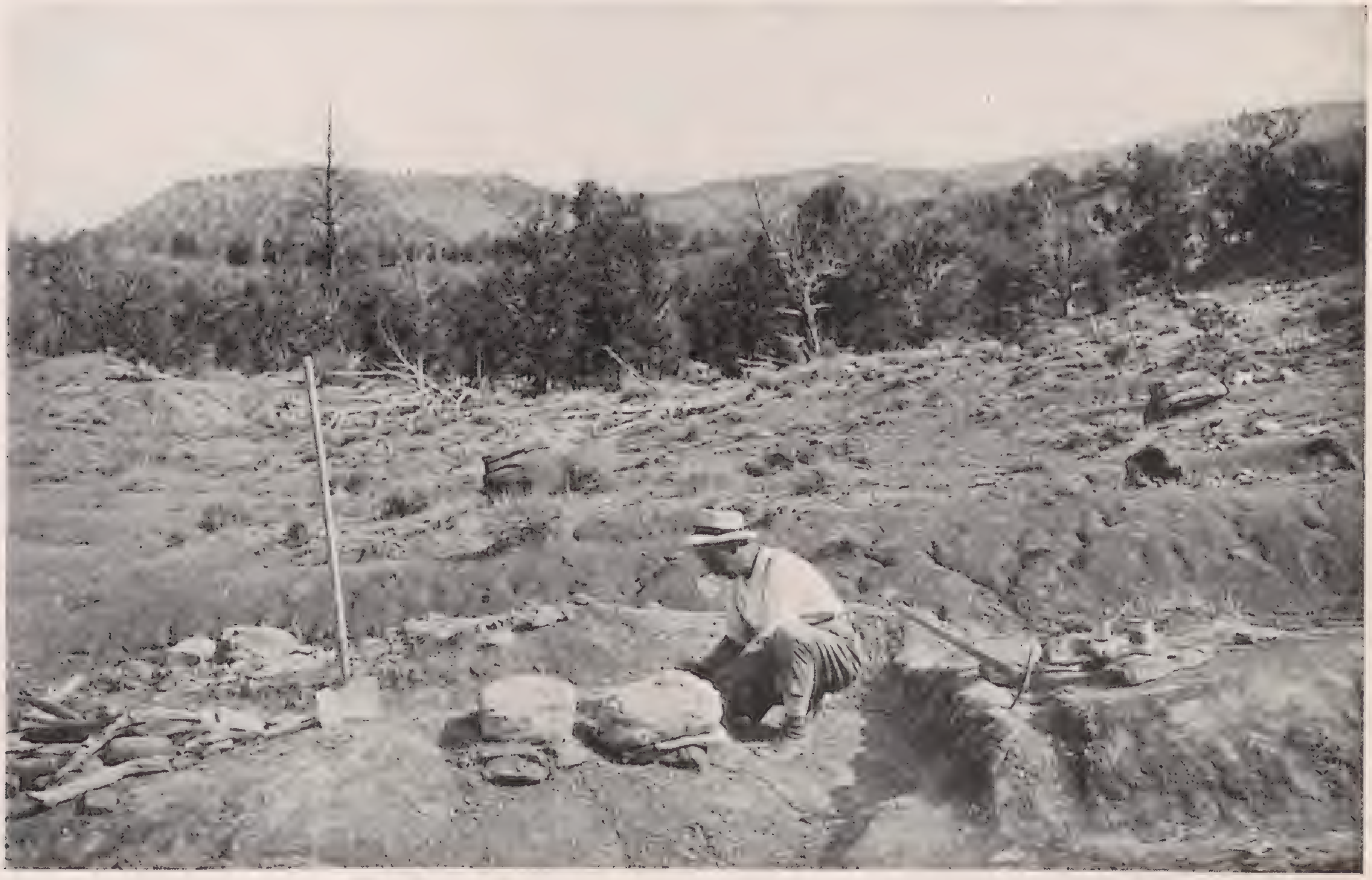


Fig. 2. Closer view of the small mammal quarry shown in Fig. 1, looking directly north. Two of the sections of matrix containing the fossils are shown ready for removal.

56.9,81 N: 14.31,4

Article XXXIII.— THE DENTITION OF NOTHODECTES.

By W. D. Matthew.

Plates XCIX–CII.

In 1915 I described under the name of *Nothodectes dubius*[1] part of a lower jaw from the Clark Fork beds at the base of the Wasatch in the Bighorn basin, Wyoming. The genus was referred to the Apatemyidæ, a small group of genera from the American Eocene, all of minute size, very imperfectly known and of very doubtful affinities.

In 1916 Mr. Granger investigated for the Museum a number of localities in the San Juan basin of New Mexico, among them one which Mr. J. W. Gidley had discovered some years earlier in reconnoissance work, and had invited us to explore as he was unable to look into it further himself. At this locality the beds were generally scantily fossiliferous but a number of specimens of fossil mammals were found, the fauna showing an admixture of Torrejon and Wasatch genera, and apparently corresponding to the similar admixture found by Mr. Granger in the Clark Fork beds of the Bighorn basin. These beds, provisionally called the Tiffany beds, were included in the 2275 feet ascribed by Gardner to the Wasatch.[2] Their stratigraphy is stated by Mr. Granger in a brief article which immediately precedes the present one.[3] Like the Clark Fork, these beds appear to be at the top of the Paleocene rather than at the base of the Eocene.

The most important find in the Tiffany beds was a small fossiliferous pocket on the Spring Creek drainage, seven miles southeast of Ignacio, near to the Mason schoolhouse. This pocket, only a meter square, of dark gray shale very fine in texture, was full of bones and fragments mostly of small or minute mammals. The preparation of the material is in progress, in the hands of Miss Erna Kohlhaase whose skilful and careful work upon these delicate fossils is deserving of high commendation. The fauna shows considerable variety, and from the observed field conditions it was suspected that it might be a fissure filling, but apparently of approximately the same geologic age as the beds which enclose and surmount it.

An incomplete skull of a small chiropteran, *Zanycteris paleocenus*, has been briefly described in a preceding article.[1] A small plagiaulacid near *Ptilodus* and a small didelphid near *Peratherium* are well represented, and several other types, mostly of minute size are recognized.

---

[1] Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 482, fig. 52.

[2] Lee, W. T., "Stratigraphy of the Coal Fields of Northern Central New Mexico." Bull. Geol. Soc. Amer., Vol. 23, pp. 571–686, 1912. (Section by J. H. Gardner on p. 584.)

[3] Granger, Walter, this Vol., pp. 821–830.

To *Nothodectes* are referred, besides eight or ten lower jaws, three palates with well preserved dentition and more or less of the front of the skull. The species is clearly related to the Wyoming *N. dubius*, and these specimens show the complete upper and lower dentition of the genus. They confirm its reference to the "Apatemyidæ," and show further that this group is nearly related to *Plesiadapis* of the Cernaysian of Europe.

Nothodectes gidleyi[2] n. sp.

Type, No. 17170, upper and lower jaws. *Paratypes*, Nos. 17171, palate, 17172, lower jaws with fragments of skeleton. All from the same pocket in the Tiffany beds near the Mason schoolhouse, Col.

Specific Characters: Size about the same as *N. dubius*. P_2 present, minute. P_3 and p_4 smaller, somewhat less robust. Trigonid of m_1 somewhat smaller.

The type specimen of *N. dubius* shows doubtful indications of a minute vestigial tooth close behind the enlarged lower front tooth. This is probably not the vestigial p_2 of *N. gidleyi*, and no corresponding vestige appears on our specimens of that species. The diastema of *N. dubius* is more sharply crested than in the new species.

The separate ?incisor conjecturally associated with the type of *N. dubius* probably does not belong to it. If it does, it differs greatly from any tooth in the dentition of *N. gidleyi*.

The generic characters do not separate it satisfactorily from *Plesiadapis* as described and figured by Lemoine,[3] but pending a revision of Lemoine's genus it seems better to retain *Nothodectes* provisionally, with the following generic characters:

Generic Characters: Dentition[4] $\frac{2.1.3.3}{1.0.3\text{–}2.3}$. Enlarged front teeth like those of *Plesiadapis* as figured by Stehlin, but with more elongate crown and an additional accessory cuspule on i^2. I^3 and c^1 small, spaced. P^2 small, in series with molars, p_2 minute or absent, in series with molars when present. P^{3-4} with large inner cusps, *pa* and *me* closely connate on p^3, distinct on p^4, *pl* distinct; p_{3-4} of moderate size, short and robust with short wide heel cusps, distinct me^d on p_4. Molars less quadrate than in some species of *Plesiadapis*, much less than in *Phenacolemur*. In *Plesiadapis remensis*

---

[1] Bull. Amer. Mus. Nat. Hist., Vol. XXXVII, Art. XX, pp. 569–571, Sept. 7, 1917.

[2] I take pleasure in naming this species in honor of my friend and former colleague J. W. Gidley, in recognition of his connection with the discovery of the Tiffany fauna.

[3] Lemoine 1891, Bull. Soc. Geol. de France, Vol. XIX, p. 278, pl. x, figs. 49–70.

[4] This formula ignores certain doubtful vestiges of i^1 noted on one specimen.

p^4, auct. Stehlin,[1] has stronger *pl* and no *me*. In another species figured by Lemoine, both p^3 and p^4 have distinct metacones.

Family characters (Plesiadapidæ): A pair of upper and lower front teeth much enlarged, soricoid in type, the upper (incisor 2?) with main cusp elongate, strongly recurved, pointed sub-spatulate with one or more accessory cuspules on outer border and with a strong posterior basal prong; the lower (incisor or canine) with long pointed simple crown, basal prong rudimentary or absent, the root elongate and extending under more or less of the molar series. Remaining incisors and canines reduced or absent, premolars reduced in varying degree. Form and pattern of premolars and molars much as in Eocene lemuroids. Molars primitive, low-crowned, bunodont, tritubercular or quadrate with hypocone, lower molars low-crowned with large basin heels, the heel of m_3 usually elongate. Posterior mental foramen beneath m_1.

Key to genera of Plesiadapidæ.

Front teeth moderately enlarged, jaw moderately deep.
  Two functional lower premolars of rather small size.
    Upper premolars, p^{3-4} sub-molariform........*Nothodectes; Plesiadapis.*
  Only one lower premolar, of large size.
    Upper premolar, p^4 molariform.......................*Phenacolemur.*
Front teeth much enlarged, jaw very short and deep anteriorly, root of lower front tooth extending under entire molar series.
  Three functional lower premolars..........................*Trogolemur.*
  Two premolars, p_3 minute, p_4 small.......................*Uintasorex.*
  Only one small premolar in series with molars..................*Apatemys.*
  Two premolars of moderate size..........................*Chiromyoides.*

Of the above genera *Plesiadapis* and *Chiromyoides* are from the Upper Paleocene of Europe, the others are American, *Nothodectes* being Upper Paleocene, *Phenacolemur* Lower Eocene, the rest Middle Eocene.

A number of other very interesting European genera with "Chiromyoid dentition" are described and their affinities discussed by Dr. Stehlin in the monograph already cited. Of these genera *Heterochiromys* and *Amphichiromys* Stehlin have rootless gliriform front teeth and do not fall into this family; Stehlin does not refer them to it. Their cheek teeth are known only from the alveoli, and their affinities appear to me to be open to a wide latitude of interpretation. *Necrosorex* Filhol of the Phosphorites and *Heterohyus* Gervais from the Lutetian of Buchsweiler are also of doubtful affinities. (See Stehlin, *l. c.*, p. 1498.)

---

[1] Saeugethiere des schw. Eocans, 7^{er} Teil, 2^{e} Half., Abh. schw. pal. Ges., Vol. XLI, p. 1476, fig. ccclv B.

Description of Teeth of Nothodectes gidleyi.

Upper teeth. A minute and doubtful vestige in front of the enlarged upper incisor may represent the first incisor, and, if so, it fixes the enlarged tooth as i^2. The large tooth is of the same soricoid type as in *Plesiadapis* but differs in details.[1] The main cusp is less sharply recurved than in the shrews, heavier and longer, with a concave posterior face, sharply convex anterior face, a strong accessory cusp on the outer margin near the apex, as in *Plesiadapis,* a second accessory cusp on the inner margin and a weak cuspule lower down on the outer margin, not present in *Plesiadapis* as figured by Stehlin. The tooth is more elongate than in *Plesiadapis* and the crown less curved. At the base of the posterior face of the main cusp is a sharp prong-like cusp projecting backward and curving downward, much as in *Plesiadapis,* not so large or prominent as in Soricidæ. The arrangement of the enamel is normal, again as in *Plesiadapis;* it is not extended downward over the root in a thickened margin as in Soricidæ. The root shows, however, a certain degree of consolidation with its alveolus, as in Soricidæ, but by no means to so marked a degree.

The supposed third incisor is a tooth of moderate size, one-rooted, with simple oval, pointed crown, somewhat flattened and spatulate. Between its root and the root of the enlarged incisor is a sunken irregular area on the outer surface of the maxilla which may possibly indicate the location of the maxillo-premaxillary suture. If so, the tooth just described is the canine. But while the course of the suture cannot be positively traced on any of the specimens at hand it appears to be more probably indicated by certain parts of the fractured line that shows on the side of the muzzle in No. 17171 (Plate C) and lies behind this tooth.

The canine (possibly p^1) is smaller than the preceding tooth and somewhat less prominent on the buccal margin of the jaw, so that it has somewhat the appearance and relations of a first premolar.

Behind i^2, i^3 and c^1 are short diastemata. The cheek teeth, p^2–m^3, are set close together but not crowded.

P^2 is a very small tooth with two connate outer roots, no inner root, and a triangular simple pointed crown.

P^3 is transversely extended with three roots, large protocone, well developed paraconule, paracone external with rudimentary metacone in its posterior flank, slight parastyle, a posterior cingulum and obsolete external cingulum. The cusps including the protocone are somewhat rounded, not crescentic, but with distinct crests on the anteroexternal and posterointernal faces of the protocone.

---

[1] Stehlin observes that this tooth has never been found in position but states the evidence for regarding it as the upper incisor of *Plesiadapis.* The *Nothodectes* dentition confirms his conclusion and removes any further doubt as to its correctness.

P^4 has similar pattern but is larger, broader, the metacone strong, parastyle stronger than in p^3, metastyle distinct though very small, paraconule prominent.

M^1 is between trigonal and quadrate in outline, broader than long, the principal cusps low and somewhat angulate, conules small and rather obscure, sharp cingula on external and anterior borders and a heavy curved cingulum in the position of the hypocone, rising anterointernally to meet the apex of the protocone, and curving around posteroexternally along the posterior margin of the tooth.

M^2 and m^3 are similarly constructed save that in m^3 the posterior external portion of the tooth, with the metacone, is reduced and low.

Lower teeth. The lower incisor is large with crown and root elongate, considerably compressed laterally, the inner face of the crown nearly flat, the anterior face strongly and the external face moderately convex. The posterior face is margined by a sharp external and an obscure internal crest, the surface between is concave from base to tip, and with a median convexity running longitudinally. At the base the outer and inner crests unite to an obscure posterior basal cusp corresponding to the prong of the upper incisor but quite rudimentary. The inner crest margining the posterior face fades out towards the tip and the tooth ends in an obliquely oval point.

P_2 is a simple minute one-rooted tooth.

P_3 is two-rooted, stout and short with wide transversely crested heel, the principal cusp with flat posterior face and convex external and internal faces and a somewhat marked anterior crest. No cingula.

P_4 is of similar pattern but somewhat larger size.

The molars have small trigonids and large deeply basined heels, the cusps low and rounded much like those of *Pelycodus*. They have obsolete external cingula.

M_1 has a distinct paraconid, internal in position, metaconid and protoconid about equal in height and size, hypoconid and entoconid a little lower, the hypoconid with a low crest that crosses to the metaconid, the entoconid with an external crest curving around the posterior border.

M_2 is similarly constructed but somewhat larger and broader, and without distinct paraconid; the metaconid is obscurely twinned, the posterior cusp having rather the relations of a metastylid.

M_3 is like m_2 except for the heel which is extended backward as a broad shelf, rising postero-internally to the level of the trigonid cusps and margined internally by a prominent curving crest that sweeps around the posterior end of the tooth in a broad curve. The surface of this shelf is somewhat rugose and the hypoconid is broken up into two or three marginal cuspules.

The zygomatic arch is deep anteriorly, the distance of the lower border of the orbit above the jaw is considerable. The orbital margin is well defined posteriorly. The lachrymal foramen lies within or upon it, clearly not external.

The lower jaw is moderately deep, somewhat shallower beneath m_3 than beneath the premolars. The mental foramina are beneath the anterior ends of p_3 and m_1. The masseteric fossa is rather deep and sharply defined above by an antero-superior crest, more obscurely beneath; the fossa reaches forward about to the posterior end of m_3. The condyle is transverse, but not extended into a wide scroll as in creodonts and Carnivora; the angle is extended in a prominent flattened process curving downward and backward, similar to the angle of many Insectivora. It is narrower than in *Lepilemur,* and contrasts with the usual broad flat angle of the Primates.

The above skull characters, while indecisive, point toward primate affinities. A number of skeleton bones probably referable here have already been extracted from the matrix — a humerus that might be either insectivore or very primitive primate, a femur with a singularly prominent lesser trochanter, a tibia with its distal articulation of primate type, unlike Insectivora, an astragalus that suggests a very early stage of primate evolution, a calcaneum, several vertebræ, sacrum, etc., of indecisive characters, and certain metapodials and phalanges strongly suggesting the primate type. Description of these is reserved until all the material has been extracted from the matrix. The indications are however that the Plesiadapidæ are not specialized Lemuroidea nor are they specialized Soricoidea but a very primitive group in some respects intermediate, although nearer to Primates than to Insectivora. Their relations to the Menotyphla (*Tupaiidæ* and *Macroscelididæ*) require further consideration.

Affinities of Nothodectes.

Stehlin's admirable figures and description of *Plesiadapis* (*l. c.*, pp. 1474, 1489, figs. ccclv-ccclix) show clearly that *Nothodectes* resembles it closely in a number of specialized features. The molars are much alike, but in *Plesiadapis* sp. a little more quadrate, with heavier hypocone flange and broader external cingula; they are intermediate in most respects between *Nothodectes* and *Phenacolemur* (an apatemyid from the Wasatch described by Matthew in 1915). The fourth upper premolar of *Plesiadapis remensis* as figured by Stehlin has the outer cusps more closely connate and the protoconule more prominent than in *Nothodectes*. On the other hand, Lemoine figures (Bull. Soc. Geol. Fr., 1890, Vol. XIX, pl. x, fig. 58) an upper jaw in which the metacone appears to be more distinct than in *Nothodectes gidleyi*. The lower premolars and molars figured by Stehlin are also much like those of *Nothodectes,* with the same heavy transversely crested heel on p_4, paraconid more distinct on the molars, m_3 with the same elongated and squared heel but the entoconid shelf narrower and more of the normal crested type — again like other genera of Apatemyidæ, especially *Phenacolemur*. The enlarged upper and lower incisors of *Plesiadapis* are of identical type with those of *Nothodectes,* differing only in being relatively smaller and less elongate and the upper tooth having only one lateral accessory cusp in addition to the basal prong. The diastema in front of the cheek teeth in *Plesiadapis* is somewhat longer.

I do not think anyone will question that the two genera are nearly related if not identical and belong certainly to the same family.

Phenacolemur of the Wasatch, known from the lower jaws and upper cheek teeth, is certainly related to *Nothodectes* and *Plesiadapis* but has more reduced and specialized premolars, more quadrate upper molars, and more enlarged lower incisor.

Apatemys, Uintasorex and *Trogolemur* are provisionally referable to the same group, but are too incompletely known for positive reference, as I have already observed (Matthew, *l. c.*, p. 478).

As to the ordinal reference of the Plesiadapidæ I am, as previously, disposed to reserve final decision until the skull and skeleton characters are more fully known. Stehlin (*l. c.*, p. 1489) speaks quite positively upon it, stating that "*Plesiadapis* is a primate," and resting his conclusion upon the undoubtedly strong evidence afforded by the primate-like character of the cheek teeth, and upon the 'Chiromyoid' specialization of the front teeth. Unquestionably the resemblance in the cheek teeth to Eocene primates is very marked. The peculiar heel of m_3 is very suggestive of that in the Notharctidæ; the characters of the premolars are considerably like those of some Eocene Tarsiidæ; and the general molar construction is very much like the Eocene Lemuroidea. The last is not a strong argument, however, for various other Eocene mammals which are certainly or probably not primates equally resemble them in molar construction. The artiodactyls *Diacodexis* and the Leptochœridæ, the condylarthran Hyopsodontidæ and Mioclænidæ, the creodont Oxyclænidæ, the insectivore Pantolestidæ and the Mixodectidæ and Microsyopidæ of more doubtful affinities have all been referred, some or all of their genera, to the Primates, upon this evidence of the resemblance of their cheek teeth to those of

Eocene and modern Lemuroidea. The characters of the skull and feet have shown conclusively when found that they belonged to other orders.

As for the resemblance in the front teeth to the modern *Chiromys,* it is not close enough to be at all convincing. The enlarged front teeth occur in many different phyla of Tertiary mammals, and the upper incisors of *Chiromys* show little if any trace of the very peculiar construction seen in the Plesiadapidæ, which is far more nearly paralleled in the Soricidæ. The European Eocene chiromyoids which Stehlin regards as in various ways intermediate and serving to connect *Chiromys* with *Plesiadapis* are too imperfectly known to afford convincing evidence. They may pertain to two or more quite distinct groups of mammals. Like the Bridger Apatemyidæ they are known only from incomplete lower jaws, and would seem to include greater diversity of form than the three Bridger genera.

Chiromys itself in the construction of its cheek teeth affords no very conclusive evidence as to its origin. They are four in number, rather featureless, small, round flat-topped, peg-like teeth with the coronal pattern obscurely quadrate. They might be derived by further specialization from the Plesiadapidæ — or from some relative of *Necrolemur,* or from some true lemurid allied to *Archæolemur.* So far as I can see the problem is not soluble by tooth characters; it will be necessary to weigh and evaluate the characters of the skull and skeleton to determine whether *Chiromys* is

(1) especially related to the Malagasy lemuroids, or

(2) derived from the Eocene tarsioids independently from the Malagasy lemuroids, or

(3) derived from the Plesiadapidæ or some other family already specialized and distinct in the Paleocene.

It is not unlikely that more complete skull and skeleton parts of *Nothodectes gidleyi* may be found in the material from the Mason pocket, most of it still buried in the matrix. It seems better therefore to reserve opinion at present as to its ordinal affinities, although, as I have intimated above, the evidence thus far obtained suggests that it is a very primitive Primate.

EXPLANATION OF PLATES.

Nothodectes gidleyi, palates and lower jaws enlarged to three diameters ($\frac{3}{1}$). From the Mason pocket in the Tiffany beds, 7 miles southeast of Ignacio, Colorado. Upper Paleocene or base of Wasatch formation, Lower Eocene.

Plate XCIX.

No. 17170, upper and lower jaws, type specimen: fig. 1, right side view; fig. 2, inferior view of left upper jaw; fig. 3, upper incisors, front view, 3a, posterior view, 3b, outside view of right upper incisor, 3c, inner view of left upper incisor, basal prong broken off.

Plate C.

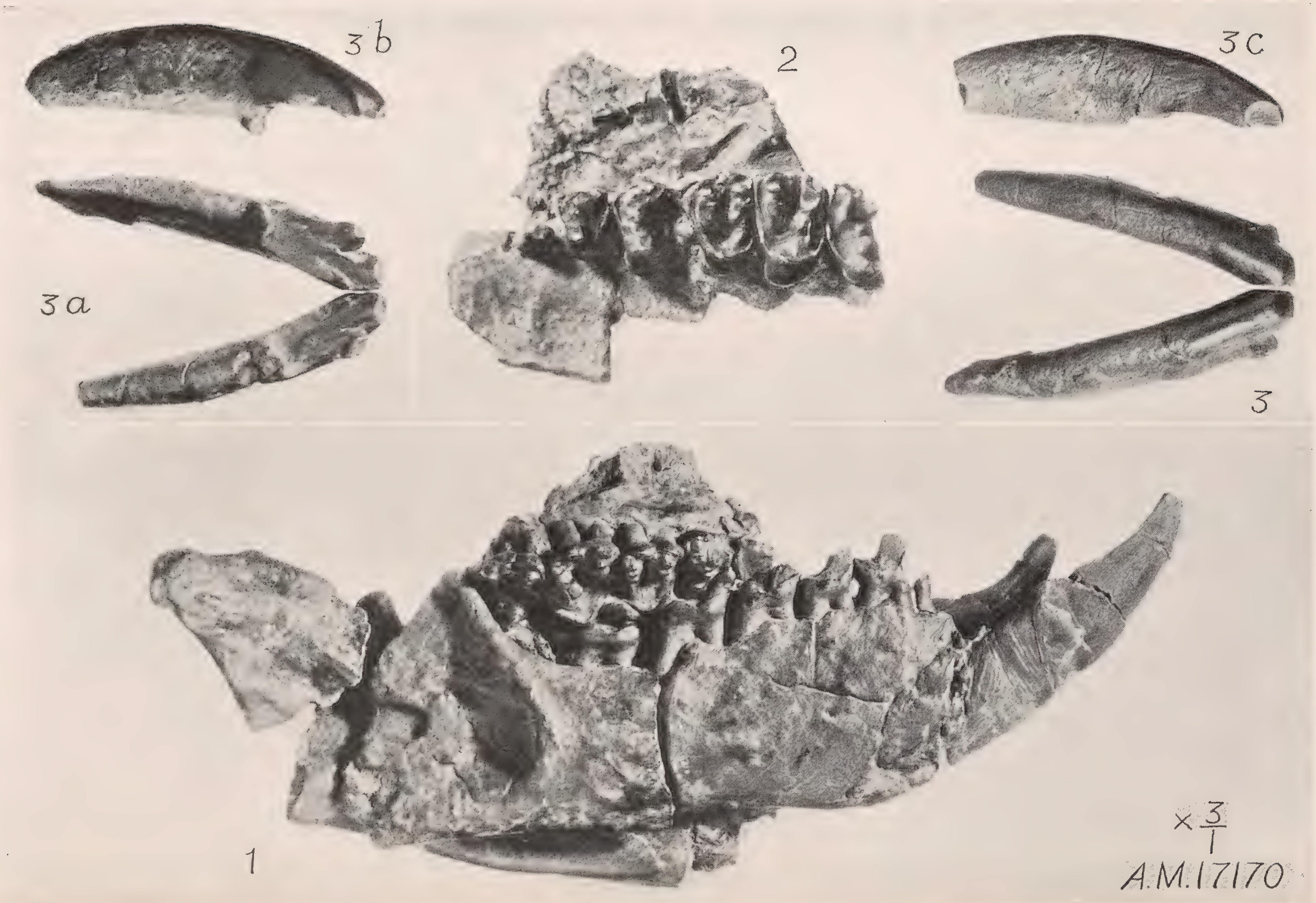
No. 17171, palate, paratype.

Plate CI.

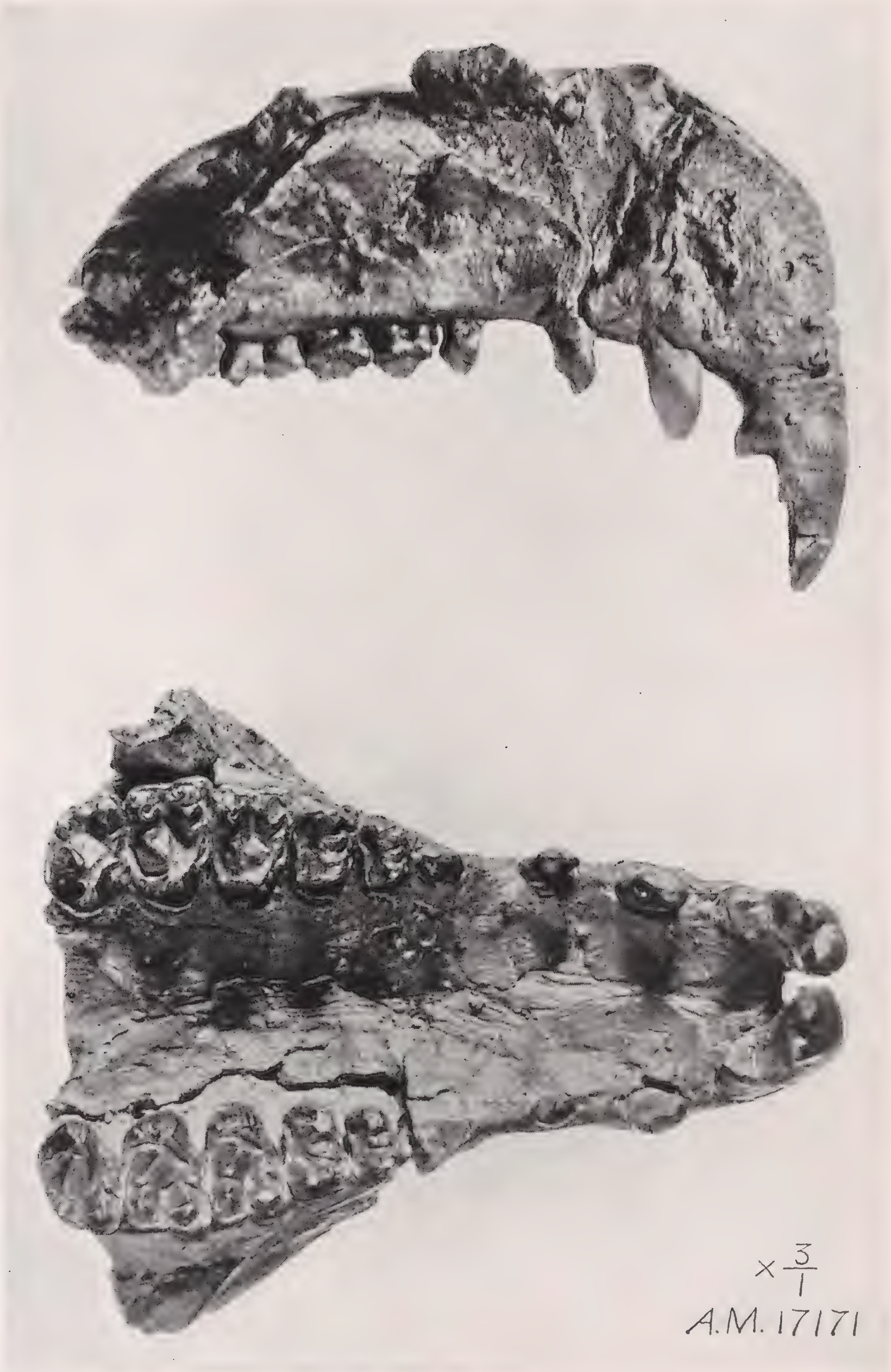
No. 17172, lower jaws, paratype. With this specimen were found parts of upper jaws of more than one individual, and a number of skeleton fragments which are not described or figured as they may not all belong to *Nothodectes.*

Plate CII.

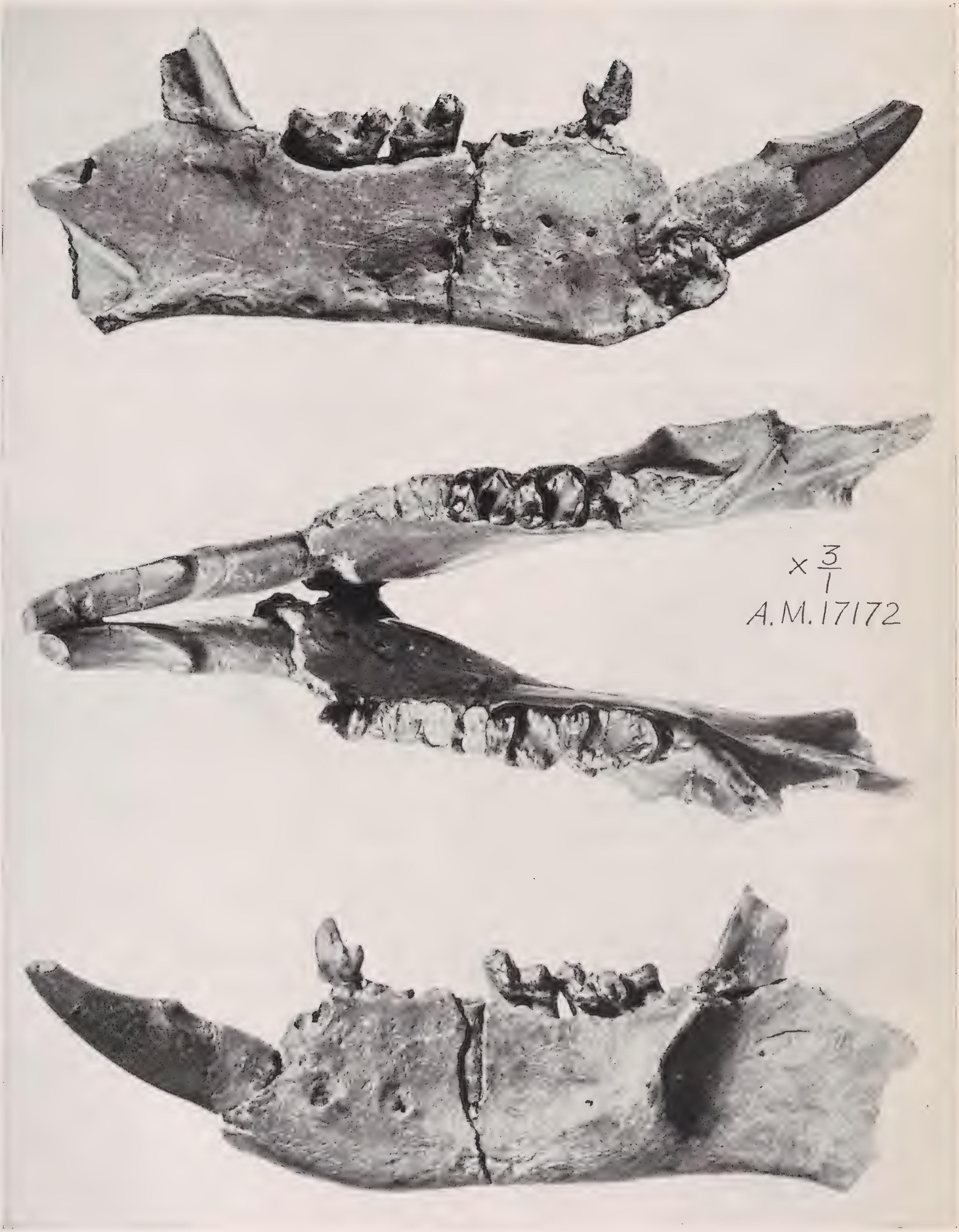
Nos. 17173, crushed palate, and 17174, lower jaw, showing unworn teeth.



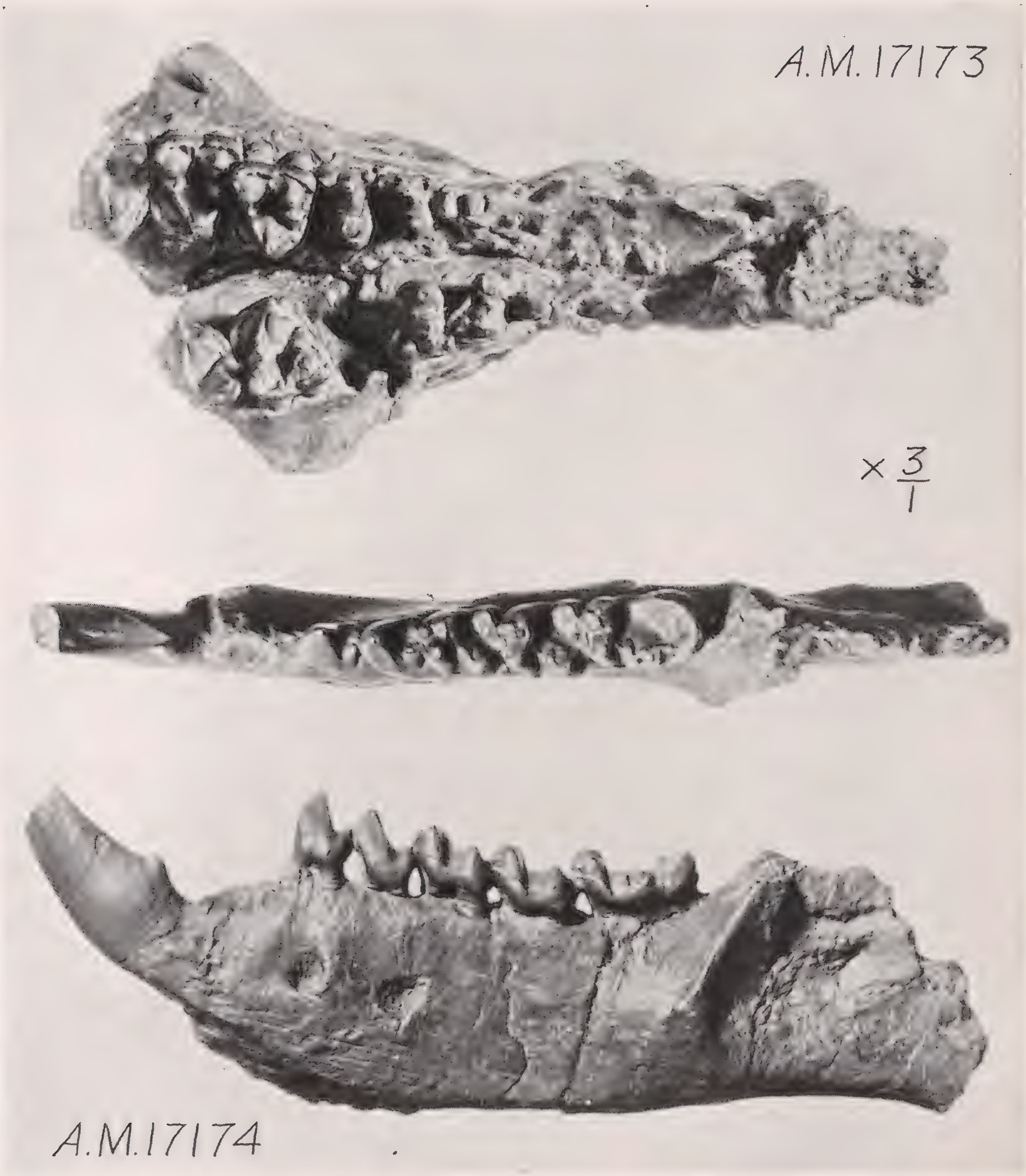
NOTHODECTES GIDLEYI.



Nothodectes gidleyi.



NOTHODECTES GIDLEYI.



Nothodectes gidleyi.

56.9.81N(1181:7)

Article XXXIV.— A REVISION OF THE EOCENE PRIMATES OF THE GENUS *NOTHARCTUS*.

By Walter Granger and William K. Gregory.

Plates CIII–CVII.

In 1902 Professor Osborn[1] referred to the genus *Notharctus* Leidy a number of Middle Eocene primates which had been placed in distinct genera by Marsh and by Cope; he traced the successive stages in the evolution of the dentition from the very primitive *Pelycodus frugivorus* of the Wasatch, with tritubercular upper molars, to the very advanced *Notharctus* (*Telmatolestes*) *crassus* of the Bridger; he defined the genera *Pelycodus* and *Notharctus* as follows:

Pelycodus.	*Notharctus.*
Jaw elongate. Mandibular symphysis uncoössified. Superior molars triangular with rudimentary hypocone; no mesostyle.	Jaw stout. Symphysis typically coössified. Superior molars quadrate with pronounced hypocone; a mesostyle.

In 1903 and 1904 the American Museum expeditions to the Bridger Basin, in charge of W. Granger, discovered much additional material of *Notharctus*, including a large number of jaws and teeth, a nearly perfect skull and two incomplete skeletons. The dentition, skull and skeletons will shortly be described from the morphological and phylogenetic viewpoint in the 'Studies on the Evolution of the Primates' by W. K. Gregory; the jaws and teeth of the Bridger Notharctinæ are studied with reference to their generic and specific characters in the present paper.

In 1905 and subsequent years the American Museum expeditions to the Lower Eocene formations of Wyoming and New Mexico, in charge of W. Granger, secured large collections of primate jaws and teeth from ascending horizons; this material was described in 1915 by Dr. Matthew,[2] who revised all the Lower Eocene species of *Pelycodus* and *Notharctus* and added the new and very primitive species *Pelycodus ralstoni* and *P. trigonodus*. He also catalogued and partly identified the new material from the Middle Eocene formation and suggested that the present writers should prepare a detailed report upon it.

---

[1] Bull. Amer. Mus. Nat. Hist., Vol. XVI, 1902, pp. 190–199.

[2] Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, 1915, pp. 433–483.

Through the generosity of Professor Lull of the Peabody Museum at Yale University we are enabled to figure for the first time Marsh's types of the species *tyrannus, affinis, anceps* and *crassus,* and to describe and figure the skull of an apparently new genus and species of Middle Eocene primate. The United States National Museum, through the courtesy of Doctor Rathbun, permitted the writers to obtain and publish photographs of Leidy's types of *Hipposyus formosus* and *H. robustior.*

The photographs for the present paper have been prepared by Mr. A. E. Anderson.

The leading specific characters of the lower teeth are summarized in Table I, p. 843. The geological succession and probable relationships of the species of *Pelycodus* and *Notharctus* are summarized in Table II, p. 844.

Order PRIMATES.

Suborder LEMURIFORMES.[1]

Family ADAPIDÆ.[2]

Subfamily NOTHARCTINÆ.

Lower and Middle Eocene, North America. Posterointernal cusp of upper molars (pseudo-hypocone) progressively arising from a ridge connected with the protocone; cingulum-hypocone not developed; m^1–m^3 progressively acquiring a mesostyle. First lower molars primitively with true paraconids located immediately in front of the metaconids; these are frequently lost, while a central median cusp (pseudo-paraconid) is frequently present; hypoconulid on m_{1-3}, no metacristid (cusp on crest behind metaconid); ramus of mandible elongate, angle not expanded, coronoid high, nearly vertical; incisors truncate spatulate; canines caniniform, high, not compressed; premolars p_1, p_2 typically spaced, p_2, p_3 not compressed; entoconid progressive on m_1, m_2; symphysis of mandible not coössified or suture distinct. Fourth upper premolar with retarded evolution of the posteroexternal cusps, which is distinct only in the later species. Lower incisors with small crowns not widely expanded; canines progressively stout and caniniform, especially in males.

---

[1] Gregory, W. K. Bull. Geol. Soc. Amer., Vol. 26, 1915, p. 432.

[2] *Ibid.*, p. 422.

Table I. Comparison of the species of Notharctus.

	WIND RIVER		BRIDGER							
	N. nunienus	N. venticolus	N. matthewi	N. osborni	N. anceps	N. affinis	N. tyrannus	N. tenebrosus	N. pugnax	N. crassus
M$_1$–m$_3$	15.5	19.4	15.	16.6	17.5	18.	18 (est.)	18.5	20.7	23.5
M$_1$–m$_2$	9.	11.8	9.	10.	10.7	11.	11.	11.3	13.	14.
Depth of ramus below center of m$_2$	8.5	13.	8.	10.5	8.5	8.3	11.2	11.8	10.5	12.3 (ref.)
Width of talonid of m$_2$	4.1	5.5	3.6	4.1	4.4	4.4	4.7 est.	4.5	5.	6.2
Condition of paraconids	Strong on m$_1$ Weaker" m$_2$ Weak " m$_3$	Pres. on m$_1$ " " m$_2$ " " m$_3$	Pres. on m$_1$ Small " m$_2$ Vest. " m$_3$	Small on m$_1$ Vest. " m$_2$ Abs. " m$_3$	Pres. on m$_1$ Vest. " m$_2$ Abs. " m$_3$	Pres. on m$_1$ Vest. " m$_2$ Abs. " m$_3$	Low on m$_1$ Abs. " m$_2$ " " m$_3$	Strong on m$_1$ Weak " m$_2$ " " m$_3$	Pres. on m$_1$ Abs. " m$_2$	Strong on m$_1$ Weak " m$_2$ Incip. " m$_3$
Accessory cusps in entoconid region of m$_3$	H'l'd double	Strong	None	Reduced	Present	Present		Present	?	Strong
External cingulum extending onto talonid	Absent on m$_1$, m$_2$; weak on m$_3$	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Variable
P$_1$, p$_2$, diastemata	P$_1$ diast. p$_2$ not	P$_1$ diast. p$_2$ not	P$_1$ diast. p$_2$ not	Pronounced	Present	Absent	Present	Present	?	Present

Table II. Progressive increase in the length of the lower molars (m_{1-3}) in Lower and Middle Eocene lemuroids of the family Adapidæ (subfamily Notharctinæ).[1]

	Horizons		
MIDDLE EOCENE	UPPER BRIDGER Bridger Basin, Wyo.	p^4 with 2 subequal external cusps m^{1-1} with large mesostyle molars quadritubercular	*N. crassus* 20.7–23.5 mm.
	LOWER BRIDGER Bridger Basin, Wyo.	*N. matthewi* 15 *osborni* 16.6 *anceps* 17.5 *affinis* 18	*tyrannus* 18 est. *tenebrosus* 18.6–19 *pugnax* 20.7
LOWER EOCENE	LOST CABIN Bighorn Basin, Wind River Basin } Wyo.	*Notharctus nunienus* 15.5	*N. venticolus* 18–19.2
	ALMAGRE[2] N. Mex.		*P. tutus* 19
	LYSITE Bighorn Basin, Wind River Basin } Wyo.	*Pelycodus frugivorus* 14–16	*P. jarovii*
	GRAY BULL Bighorn Basin, Wyo. UPPER	*P. frugivorus*	*P. jarovii* 16–18
	LOWER	*P. trigonodus* 15 *P. ralstoni*	*P. jarovii*
	SAND COULEE Clark Fork Basin, Wyo.	*Pelycodus ralstoni* 11–14 mm.	p^4 with 1 external cusp, m^{1-3} without mesostyle, molars tritubercular

If it were not for the annectant characters of *N. anceps, affinis* and *tyrannus* the genus *Notharctus* might be divided into two subgenera, typified by *N. matthewi* and *N. crassus*.

---

[1] Data for Lower Eocene species compiled from Matthew, 'A Revision of the Lower Eocene, Wasatch and Wind River Faunas.'

[2] The upper levels of the Almagre of New Mexico are perhaps equivalent to the Lysite. Granger, Bull. Amer. Mus. Nat. Hist., Vol. XXXIII, 1914, p. 207.

Genus **Notharctus** Leidy 1870.

Type, Notharctus tenebrosus Leidy, Proc. Acad. Nat. Sci. Phila., 1870, p. 114.

(Defined as above, p. 841).

Limnotherium Marsh, Amer. Jour. Sci., Vol. II, "June 5th, 1871," pp. 11, 12.
Thinolestes Marsh, Amer. Jour. Sci., Vol. IV, "Aug. 7th, 1872," p. 13.
Telmatolestes Marsh, Amer. Jour. Sci., Vol. IV, "Aug. 7, 1872," p. 14.
Tomitherium Cope, Palæont. Bull. No. 3, "Aug. 7th, 1872," Proc. Amer. Phil. Soc., Vol. XII, p. 470.
Hipposyus Leidy, Proc. Acad. Nat. Sci. Phila., 1872 (June 25), p. 37.

The types of the type species of the genera *Notharctus, Hipposyus, Limnotherium, Thinolestes, Tomitherium* were carefully studied by the present writers, comparisons also being made with referred material in the American and Yale Museums. We were unable to perceive generic distinctions between these types and we therefore follow Osborn (1902, pp. 195–198) and Matthew (1899, p. 37) in regarding *Limnotherium, Thinolestes, Tomitherium* and *Hipposyus* as synonyms of *Notharctus*. Even the large and progressive Upper Bridger form described by Marsh as *Telmatolestes crassus* falls within the generic definition of *Notharctus* and is connected with the more typical species by the new species, *N. pugnax,* described below.

Although *Notharctus* is characteristic of the Middle Eocene two species (*N. nunienus, N. venticolus*) occur in the Lost Cabin formation in the Wind River Basin at the summit of the Lower Eocene.

Notharctus nunienus (*Cope*).

Matthew, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, pp. 444–445, Fig. 19.

"*Type,* [Amer. Mus.] No. 4734, lower jaw with p_3–m_3 r. from Lost Cabin beds of Wind River basin, Wyoming.

Distinctive characters: $M_{1-3} = 15$ mm.; heel of m_3 bicuspid; symphysis of jaw not coössified." (Matthew.)

". . . . a little larger than *P*[*elycodus*]. *frugivorus* and distinguished by the more strongly developed hypocones — not as strong, however, as in *N. venticolus.* The species would be considered a mutation of *frugivorus* except that the one is referable to *Notharctus* and the other to *Pelycodus*, according to the distinctions established by Osborn." (Matthew.)

This species somewhat resembles *N. osborni* of the Lower Bridger in its narrow molars; but it is distinctly smaller and has two prominent cusps on the heel of m_3; true paraconids distinct, placed internally, immediately in front of metaconids; molars m_1, m_2 relatively shorter and wider, ramus shallow; p_2 compressed with two very distinct roots; p_4 with higher protoconid.

Notharctus venticolus *Osborn.*

Osborn, 1902, Bull. Amer. Mus. Nat. Hist., Vol. XVI, p. 195; Matthew, 1915, *ibid.*, Vol. XXXIV, pp. 443–444, figs. 16, 17.

"*Type*, [Amer. Mus.] No. 4715b, parts of upper and lower jaws, from the Lost Cabin zone in the Wind River basin, Wyoming.

Distinctive characters: M_{1-3} = 18 mm.; symphysis of jaw not coössified." (Matthew.)

Differs from *N. tenebrosus* type in larger molars, especially m_3, and well spaced p_1; jaw longer, lower canine larger. Small true paraconid on m_1, m_2, placed very close to metaconids, fainter on m_3; m_3 with two very small cusps in entoconid region. External cingulum of molars delicate; p_4 with distinct metaconid, p_2 with two roots. Root at p_1 with external groove indicating an incipient tendency to divide the single root into two. Upper premolars and molars with internal cingula faint or absent, hypocones of m^1, m^2 not large, mesostyles small, external cingula delicate; m^1–m^3 = 15 mm.

Measurements.

(From Amer. Mus. No. 14655).

	mm.
P_1–m_3	35.
P_1–m_2	27.
M_1–m_3	19.4
M_2 ap. × tr.	5.5 × 5.5
M_3 ap.	7.6

Notharctus sp.

From the Huerfano Basin, Colo., there is a single specimen (No. 17020, Coll. of 1916) referable to the Notharctinæ; it consists of two fragments of the right ramus of the lower jaw supporting p_3, p_4 and m_3 and has the alveoli of the canine and anterior premolars. This individual comes from the upper levels of the Huerfano where it was associated with *Tillotherium. Hyrachyus* and other Lower Bridger genera. The exact position of the fauna of the upper Huerfano has not yet been determined but from the collections and studies made to date it appears to be intermediate between the Bridger and the Wind River (Lost Cabin) faunas with, however, more resemblance to the former than to the latter. For this reason this specimen may properly be considered as belonging to the genus *Notharctus* rather than to *Pelycodus* although it presents no characters to definitely place it in either genus. In size it is about equal to *P. ralstoni,* from the base of the Wasatch, and is therefore smaller than any Wind River or Bridger species of the Notharctinæ. The m_3 has a double hypoconulid as in *N. nunienus* but differs from it in the much smaller size and in lack of the paraconid. The Bridger form which approaches it most closely in size is *N. matthewi* but this has a single hypoconulid on m_3 and a larger p_3 with a better developed talonid as well as a much deeper ramus anteriorly. In the slenderness of the symphysial region and in the reduction and simplicity of the p_3 this Huerfano specimen is hardly equalled even in *P. ralstoni,* the most primitive species of this subfamily. The p_4 of the present form shows a strong well separated metaconid and a moderate talonid, a tooth, on the whole, rather closer to the *Notharctus* than to the *Pelycodus* stage of development.

Measurements of No. 17020.

	mm.
P_1–m_3	25. est.
M_{1-3}	14.5 est.
M_3 ap. × tr.	5.5 × 3.
Depth of ramus at m_2	7.5

Notharctus matthewi sp. nov.

Plate CIII, Fig. 1; Plate CIV, Fig. 1; Plate CVI, Fig. 1.

Type, Amer. Mus. No. 12011, lower jaw and p^3–m^1 right, from Grizzly Buttes, East, Bridger Basin, Wyoming, level B 2.

Distinctive characters: $m_{1-3} = 15$ mm.; symphysis not coössified; no true paraconids; pseudo-paraconid present on m_1, centrally placed, small on m_2, vestigial on m_3; external cingulum well defined on p_4–m_3; hypoconulid of m_3 single. P_4 with metaconid indistinct, low, not constricted from protoconid; p_1 spaced in front and behind; p_2 not spaced; p_1, p_2 with a single root. Canine delicate, erect, not caniniform, but much like p_1. Ramus fairly deep, about as in *N. osborni.* Upper molars: posterointernal cusp small on m^1, a little stronger on m^2, barely differentiated from the protocone ridge; small mesostyle; contour of molar crown more quadrate internally than in Lower Eocene forms; p^4 without tritocone (outer cusp single).

Recognized as a distinct species by Dr. Matthew who noted its primitive features.

Amer. Mus. No. 13030, upper and lower jaws with fragmentary skeleton, from Lower Cottonwood Creek, Bridger Basin, level B3, agrees with *N. matthewi* in the retarded state of the hypocones, in the uncoössified symphysis, in the single outer cusp on p^4 and in the absence of true paraconids, but is somewhat more progressive in the development of the mesostyle.

Measurements.

	mm.
P_1–m_3	26.2
M_{1-2}	9.
M_{1-3}	15.
M_2 ap. × tr.	4.7 × 3.6
M^{1-2}	8.5
M^2 trans.	5.3

In the lower teeth this species closely resembles *N. osborni,* differing only in the smaller size, lack of diastema behind p_2, weaker metaconid on p_4, pseudo-paraconids present. It agrees with *Pelycodus* in the following characters: symphysis not coössified, postero-internal cusps very weak on m^1, m^2, metaconid on p_4 weak. It resembles *Notharctus* in having mesostyles on the upper molars and in their quadrate character. It is evidently a persistently primitive survival of the older genus *Pelycodus,* which has acquired only a few of the progressive *Notharctus* characters.

Referred material: Amer. Mus. No. 12566, Middle Cottonwood Creek, level B3, lower jaw and upper molars (posterointernal cusps more advanced than in type).

Notharctus osborni.

Plate CIII, Fig. 2; Plate CIV, Fig. 2.

Notharctus formosus Gregory, 1916, Bull. Amer. Mus. Nat. Hist., Vol. XXXV, p. 262. Nec *Hipposyus formosus* Leidy.

Type, Amer. Mus. No. 11466, nearly complete skull and lower jaw, from Grizzly Buttes, West, horizon B2, Bridger Basin, Wyoming.

Distinctive characters: Differs from *tyrannus, anceps* and *affinis* Marsh in the smaller and more slender lower molars with narrower talonids; m_3 has the two cusps of the entoconid region very small; true paraconids absent on m_1, m_2; a small paraconid (?pseudo-paraconid on m_2, m_3). External cingula not extending on talonid. Ramus of lower jaw deep in type (10.5 mm. below center of m_2), shallow in referred specimen (A. M. 11474, skel. A, 9.3 mm.). Lower canines small, with low crown (?a female character). P_1, p_2 spaced (diastemata closed in *affinis*); p_3 shorter than in *anceps,* with small talonid; p_4 with metaconid smaller than in *anceps;* p^4–m^3 with internal cingula weak (well defined in anceps); p^4 less progressive than in *affinis;* internal cingulum weak.

Measurements of type.

	mm.
P_1–m_3	31.4
M_1–m_3	16.6
M_1–m_2	10.
M_2 tr.	4.1
M_3 ap.	6.4
P^1–m^3	27.3
M^1–m^2	13.7
M^1–m^2	10.
P^3–m^2	17.3

Referred specimens: Paratype, Amer. Mus. No. 11474, from Little Dry Creek, Bridger, Lower beds, Bridger Basin, Wyoming, lower jaws (incomplete in front) and fragments of skull associated with the greater part of the skeleton; Amer. Mus. No. 12569, from Grizzly Buttes, East, Bridger Basin, level B2, upper jaws associated with right and left periotic.

Notharctus anceps (*Marsh*).

Plate CIV, Fig. 3; Plate CVI, Figs. 2, 2a.

Thinolestes anceps Marsh, Amer. Jour. Sci., Vol. IV, "Aug. 7, 1872," p. 13.

Cotypes, 11786 A (lectotype) and 11786 B Yale Mus., from Grizzly Buttes, Wyo. Two individuals both with upper and lower teeth. Description and measurements taken from 11786 A (lectotype) consisting of lower jaws with m_1 right and roots or alveoli of anterior teeth including (right) canine, p_1–m_3 left and alveolus of canine (left, Plate II, fig. 3); m^1–m^3 left and p^1–p^4 right (Plate IV, Figs. 2, 2a). Teeth unworn; outer surface of p^4 broken. This is the specimen upon which Marsh's description and measurements are based.

Distinctive characters (lectotype); m_1, m_2 very similar to type of *affinis*, m_3 differing in having two accessory cusps in entoconid region more distinct; paraconid (?pseudo-paraconid) present in m_1, vestigial in m_2, as in *affinis* and other lower beds forms; entoconids stronger; p_1, p_2 spaced, p_4 with high metaconid, almost as high as protoconid, and high trenchant heel. Canine much larger than p_1, p_2 with single root (as in *osborni*); ramus as in *affinis*. Upper molars as in *affinis;* p^3, p^4 less progressive than in *affinis*, *i. e.*, p^4 lacks tetartocone and is narrower transversely; p^3 with deuterocone very small and low.

Measurements of type (lectotype).

	mm.
P_1–m_3	32.7
M_1–m_3	17.5
M_1–m_2	10.7
Ramus below m_2, depth	8.5
M^1–m^3	15.
M^1–m^2	10.5

Differs from *tyrannus* in shallower ramus; width of talonid as in *affinis*.

Yale Mus. 11786 B (2nd cotype) consists of lower jaw fragments with m_1, m_2 right, p_4–m_3 left (Plate CIV, Fig. 4), p^3–m^3 right (Plate CVI, Fig. 3), and left; all damaged.

The second cotype 11786 B differs from the lectotype (11786 A) in having the tritocone of p^4 and the deuterocone of p^3 in a very early stage while that of the lectotype is a prominent cusp; also a corresponding difference in the lower p_4, which in 11786 B has the metaconid down on the side of the crown, much below the level of the protoconid, while in the lectotype the metaconid is high, nearly on a level with the protoconid. The specific reference of the second cotype therefore is somewhat doubtful.

Notharctus affinis (*Marsh*).

Plate CIII, Fig. 3; Plate CV, Fig. 1.

Linotherium affine MARSH, Amer. Jour. Sci., Vol. IV, "Aug. 7, 1872," p. 14.

Type, Yale Mus. 11795. No locality given (but probably Lower Bridger). Lower jaw with m_{1-3} right and alveoli of i_1–p_4, symphysis and p_3 of left, with alveoli of i_1–p_2. Mounted separately, but apparently the same individual, a lower jaw fragment with m_{2-3} and fragment of upper maxilla, p^3–m^2 left and p^3–m^1 right. Young individual, last molar just wearing.

Distinctive characters: Differs from the type of *L. tyrannus* in marked shallowness of jaw and smaller canine. Trigonids and basins of m_1, m_2 narrower; entoconids on m_1, m_2 weaker; symphysis shallower, reaching to anterior border of p_3. Measurements: m_{1-2}, ap. 11 mm. as in *tyrannus*, m_2 tr., 4.4 mm. slightly less than that of *tyrannus;* m_{1-3}, ap. 18 mm.; ramus below center of m_2, 8.3. Paraconid (?pseudo-paraconid) present on m_1 practically vestigial on m_2, absent on m_3; hypoconulid on m_3 weak; internal accessory cusp in entoconid region slightly developed. Canine alveolus slightly larger than that of p_1. Differs from *rostratus* in smaller size and narrow trigonids; entoconids lower; ramus shallower; symphysis shorter and shallower. Differs from *osborni* in the much larger size of the third lower molar, longer molar row, shallower ramus, thicker, p_1, p_2 apparently without diastemata; p^3 with high conical inner cusp (deuterocone); p^4 progressive with subequal outer cusps, mesostyle wanting, parastyle nearly as large as in m^1, m^2; metastyle slight; deuterocone large, the postero-internal cusp visible; upper molars hardly separable from those of *anceps;* m^1–m^2, 10.7 mm., m^2 trans., 1 mm., p^3–m^2, 18.5 mm.

Notharctus tyrannus (*Marsh*).

Plate CIII, Fig. 4, Plate CIV, Fig. 6.

Limnotherium tyrannus MARSH, Amer. Journ. Sci., Vol. II, "June 5th, 1871," pp. 11, 12.

Type, Yale Mus. 11856, from Dry Creek, Grizzly Buttes. Lower jaw with m_1, m_2 right, roots or alveoli of all anterior teeth around to p_3 left.

Distinctive characters: Canine much larger than p_1; i_2 larger than i_1. Low paraconid (?pseudo-paraconid) on m_1, vestigial or absent on m_2; talonid basins wide, especially on m_2. Ramus unusually deep; symphysis extending back to posterior border of p_3; small diastema in front and behind p_2, p_1 probably spaced.

Measurements.

	mm.
M_1–m_2	11.
M_2 trans. tal^d	4.7 est.
Depth of ramus below center of m_2	11.2

Referred specimens: Amer. Mus. 11478 (Plate CIII, Fig. 5; Plate CIV, Fig. 5), level B, associated with portions of skeleton; may be regarded as female of this species; m_1, m_2 compare closely; differs in shallowness of jaw and probable slenderness of canine. The upper molars although weathered are distinctly larger than those of *N. osborni;* they are a little larger than those of *affinis;* the third premolar is decidedly narrower transversely than that of *N. affinis* and the same is true of m^2; this relative narrowness in *tyrannus* is seen in all the cheek teeth preserved. The upper premolars differ from those of *N. anceps* in being generally simpler; p^2 is single-rooted (double-rooted in *anceps*) deuterocone on p^3 and p^4 less developed.

Amer. Mus. 12002, Hor. B 1, lower jaw.

Notharctus tenebrosus *Leidy*.

Plate CIII, Fig. 6; Plate CV, Fig. 3.

Proc. Acad. Nat. Sci. Phila., 1870, p. 114.

Hipposyus formosus LEIDY, Proc. Acad. Nat. Sci. Phila., 1872 (June 25), p. 37, Contr. to Extinct Fauna West. Terrs., 1873, p. 90, pl. vi, fig. 41.

Tomitherium rostratum COPE, Palæont. Bull. No. 3, "Aug. 7th, 1872," Proc. Amer. Phil. Soc., Vol. XII, p. 470.

Type, U. S. Nat. Mus. 3752, Black's Fork, Bridger Basin, level B. Right ramus with canine, p_2–m_3 and alveoli of incisors and p_1, condyle; coronoid and angle wanting. F. V. Hayden Coll. 1870.

Distinctive characters: True paraconids on all three molars, strong on m_1, weaker on m_2, m_3. Entoconid region with small accessory cusps. Diastema in front of p_1 and between p_2 and p_3. On account of the worn condition of the teeth few very distinctive characters are afforded; but the dentition on the whole seems to be close to that of *N. rostratus,* differing chiefly in the presence of a paraconid on m_3.

Referred specimens: Amer. Mus. 5009, type of *T. rostratum* (see below); Amer. Mus. 13024, Lower Cottonwood Creek, lower jaws, limb and foot bones; Amer. Mus. 14568, Grizzly Buttes B3, pair of lower jaws, with p_3–m_3; Amer. Mus. 12001, Cottonwood Creek, Bridger Basin, level B4; Amer. Mus. 13022, Grizzly Buttes, Bridger B2.

Measurements (from type).

	mm.
P_1–m_3	33.
M_2 ap. × tr.	5.5 × 4.5
M_1–m_3	18.5
M_{1-2}	11.3
Depth of ramus below center of m_2	11.8

Type of *Hipposyus formosus* Leidy.

Plate CVI, Fig. 5.

The type consists of a fragment of a left maxilla containing parts of all three molars collected by Dr. Carter. It is preserved in the U. S. National Museum, No. 3757, "Dry Creek near Ft. Bridger, Wyoming" (Little Dry Creek of American Museum collectors, a tributary of Smith's Fork, near Grizzly Buttes, Horizon B). The specimen articulates accurately with Cope's type lower teeth of *Tomitherium rostratum* (*Notharctus tenebrosus* Leidy) from the same level.

The detailed characters of the molars are as follows:

M^1, m^2 are rather less quadrate in outline than those of *N. pugnax* and are also smaller in all dimensions; the pseudo-hypocone on m^2 is less developed than in that species; the internal cingulum on m^2 is heavy; on the inner border of m^1, m^2 there is no constriction between the protocone and pseudo-hypocone (strong in *pugnax*).

Measurements.

	mm.
M^1–m^2	10.8
M^1 trans.	7.2

Type of *Tomitherium rostratum* Cope.

Plate CIII, Fig. 7; Plate CV, Fig. 2.

Tomitherium rostratum Cope, Palæont. Bull. No. 3, "Aug. 7th, 1872"; Proc. Amer. Philos. Soc., Vol. XII, p. 470.

Type, Amer. Mus. 5009, Black's Fork, Lower Bridger, lower jaw with both rami, and portion of left ascending ramus, i_1 and p_1–m_3 right, p_4–m_3 left; roots or alveoli of all the other teeth.

Distinctive characters: Molars larger than in *tyrannus, anceps, affinis* and much larger than in *osborni*. Talonid basins of moderate width (between *affinis* and *tyrannus*); p_1, p_2 separated by small diastemata from each other and from the canine and p_3. Canines small or moderate. Symphysis long and sloping, ending posteriorly opposite posterior border of p_3. Heavy external cingulum on p_3. True paraconids present on m_1, m_2.

Measurements of type.

	mm.
P_1–m_3	35. est.
M_1–m_3	19. est.
M_1–m_2	11.7
M_2 trans.	4.6
Depth of ramus below center of m_2	10.5

We are unable to distinguish this as a separate species from *N. tenebrosus* Leidy from which it differs chiefly in the slightly larger measurements of the premolar-molar series, and of the canines; the paraconid is absent on m_2, m_3.

Notharctus pugnax sp. nov.

Plate CIII, Fig. 8; Plate CV, Fig. 4.

Type, Amer. Mus. 11461, Millersville, Lower Bridger. Left ramus with p_3–m_2 and roots or alveoli of c, p_1, p_2, m_3.

Distinctive characters: Lower jaw and teeth larger and heavier than in any other Lower Bridger species including *rostratus*, but smaller than in the Upper Bridger *Telmatolestes crassus*, toward which the present species is apparently tending. P_4 with strong internal and external cingula; molars with external cingula sharply defined and continued around talonid. Metaconid of p_4 large. True paraconid present on m_1 (in front of metaconid), absent in m_2. Ramus shallow (depth below m_2, 10.5) but very stout and thick, symphysis stocky.

Paratype, Amer. Mus. 11480, a nearly complete lower jaw of an aged individual very little crushed and with dentition complete except for the p_1 right. Locality, Grizzly Buttes, Horizon B, Bridger Basin.

Measurements of paratype.

	mm.
Front of canine to m_3 incl.	42.5
M_{1-3}	21.
M_{1-2}	13.
M_2 ap. × tr.	6.8 × 5.5

As far as one can judge this species appears to be ancestral to *N. crassus* of the Upper Bridger. It appears to be related to *N. tenebrosus* and may well be derived from *N. venticolus* with which it agrees in size and in the character of m_3. It differs from *venticolus* in the weaker paraconids and shallower ramus.

Referred specimens: Amer. Mus. 11452, from Church Buttes (low down in Horizon B), ramus shallow but stocky. Amer. Mus. 12575, lower jaw and fragments of upper, Grizzly Buttes, East, B2. Amer. Mus. 14567, p^2–m^3 Grizzly Buttes, B3. Amer. Mus. 11454, Millersville, level B.

Measurements of type.

	mm.
P_2–m_3	34.
M_1–m_3	20.7
M_1–m_2	13.
M_2 trans.	5.

Notharctus crassus (*Marsh*).

Plate CIII, Fig. 9; Plate CV, Fig. 6.

Telmatolestes crassus MARSH, Amer. Jour. Sci., Vol. IV, "Aug. 7, 1872," p. 14.

Notharctus robustior LEIDY, U. S. Geol. Surv. Montana, etc.; F. V. HAYDEN, Report for 1871 [1872], p. 364.

Hipposyus robustior LEIDY, Contrib. Ext. Vert. Fauna West. Terr., pl. VI, fig. 40.

Type, Yale Mus. 11782, Henry's Fork, Bridger. Bone and teeth white (from white stratum in Upper Bridger). M^1–m^3, left, damaged; fragment of left ramus with alveoli of canine, p_1 p_2; p_3–m_3, right, preserved; other fragments of upper and lower teeth.

Distinctive characters: Of large size. P_4 submolariform with large paraconid, metaconid large and widely separated from protoconid; true paraconid large on m_1; pseudo-paraconid at end of protoconid ridge on m_1, weaker on m_2, incipient on m_3; m_1, m_2 with wide talonids; m_3 narrow elongate with low crenulate ridge in region of entoconid. Ridge connecting protolophid with hypoconid prominent. External cingula of molars crenulate. Ramus massive. P^1 and p$_1$ double rooted, p^3 with low deuterocone, p^4 with tritocone nearly equal to protocone, internal lobe of p^4 wide, with low tetartocone or deep tetartocone groove; m^1, m^2 very progressive with large hypocones on m^1 m^2 and large mesostyles on m^1–m^3; m^3 subquadrate with hypocone incipient on cingulum. Metaconule distinct on all three molars.

Measurements of type.

	mm.
P$_1$–m$_3$	40.5
M$_1$–m$_3$	23.5
M$_1$–m$_2$	14.3
M$_2$ trans.	6.2
M$_3$ ap.	.97
Depth of ramus below m$_2$ (referred)	12.3
M^1–m^3	16.6
P^4 ap. × tr.	4.7 × 8.1

There is no sharp generic distinction between *Telmatolestes* and *Notharctus.* Various specimens of *N. pugnax* and *N. crassus* show transitional conditions in the development of the hypocone on m$_3$, in the separation of the tritocone from the deuterocone in p^4, and in the development of the mesostyle, in the separation of the metaconid on p$_4$. *N. crassus* is the only known species of *Notharctus* in the Upper Bridger where it was very abundant, the American Museum collections comprising more than 25 catalogued specimens.

Referred material: Amer. Mus. 12567, palate and skull frag'ts, Henry's Fork Hill, Bridger Basin, level D4; Amer. Mus. 13133, lower jaw from N. of Haystack Mt'n, Washakie Basin (Lower Washakie, Horizon A); Amer. Mus. 13134, Kinney Ranch, Wash. (basal beds); Amer. Mus. 12564, from Henry's Fork, Bridger Basin, level D4, upper and lower teeth; Amer. Mus. 12588, Sage Creek Spr., Bridger Basin, Horizon C; Amer. Mus. 11982, Henry's Fork, Bridger Basin, Horizon C4, upper and lower jaws.

Type of *Hipposyus robustior* Leidy.

Plate CVII, Fig. 5.

Type, a fragment of the left ramus mandibuli, containing m$_2$ and alveolus of m$_3$. U. S. Nat. Mus. No. 3750, F. V. Hayden Coll. 1870.

Locality. Henry's Fork (Horizon C or D), Bridger Basin, Wyoming.

Although slightly smaller than the type of *Telmatolestes crassus* Marsh

Leidy's type clearly falls within the range of variation of specimens referred to the latter species.

Hayden's Report for 1871, containing the description of this species, bears a letter of transmittal dated February 20, 1872; the actual date of publication is not known to us, but very probably was not earlier than Marsh's paper containing the description of *Telmatolestes crassus* from the same level which bears the date Aug. 7. Unless the priority of *robustior* can be established it seems better to retain Marsh's name *crassus*, both because it has been generally adopted and because it was founded on a much better type.

Measurements.

	mm.
M_2 trans.	5.7
M_2 ap.	7.5

? **Notharctus uintensis** (*Osborn*).

?"*Microsyops*" *uintensis* Osborn, 1902, p. 202, fig. 27.

Left incertæ sedis by Osborn, with the remark "Its nearer reference is either to the Anaptomorphidæ or to some member of the Notharctidæ." Provisionally referred by Dr. Matthew in Amer. Mus. catalogue to *?Notharctus*. Examination of type and comparison with *Hemiacodon* with all other Anaptomorphidæ and all types of *Notharctus* tend to confirm the reference by Matthew.

It differs from *Hemiacodon* in the characters of the 3rd pm which is less advanced than in the older genus; talonid of p_4 not as wide as in *Hemiacodon;* trigonid of m_2 lacks pa^d (present in *Hemiacodon*). P_3, p_4 on the whole nearer to *N. crassus* but trigonids of ms smaller and talonids wider. An approach to the widening of the talonid is shown in *crassus,* but that species retains the paraconid on m_2; the external cingulum is vestigial (present in *crassus*).

On the whole the species *?N. uintensis* seems referable to *Notharctus* and thus it represents the latest record of the family.

Aphanolemur gibbosus gen. et sp. nov.

Plate CVII.

Type, a skull, lacking the dentition and the fore part of the muzzle, No. 12152 Peabody Mus. Nat. Hist., Yale University.

Locality and level: Millersville, Lower Bridger, Bridger Basin, Wyo.

Distinctive characters: Skull short and wide. Brain-case well expanded transversely, sagittal crest very short, diverging anteriorly into two sharp temporal crests.

A pair of prominent swellings on the forehead between the orbits. Muzzle apparently narrow. Orbits large, malar below orbit wide. Occiput wide, evenly rounded above. Auditory bullæ prominent, subspherical. M^3 apparently wide transversely. Greatest width of brain-case (above squamosal suture) 29.5 mm. Length of sagittal crest 7. mm.

It is extremely unfortunate that the dentition is lacking from this important skull, which in its original condition might have thrown light upon the relationships of several families of Eocene lemuroids. In the swelling form of the brain-case and fairly large orbits it suggests the Eocene Tarsiidæ (*Tetonius,* etc.), although not nearly so specialized as that older genus. It is apparently excluded from the contemporary *Hemiacodon* of that family by its distinctly larger size, and for the same reason it is hardly likely to belong to *Microsyops* of the Microsyopinæ. It is also excluded from *Microsyops* by the possession of a complete postorbital ring. It agrees with *Notharctus* in fundamental construction: first in the relation of the lacrymal which lies within the orbit and has a wide contact with the frontal; secondly it is essentially similar in the general form and relations of the postorbital processes of the malar and frontal and in the insertion of the masseter below the orbit; thirdly in the construction of the auditory bulla, and in the course of the internal artery, which passed through an ossified tube, lying upon the auditory prominence as very clearly shown on the left side of the type. The skull differs from that of *Notharctus* in its protuberant brachycephalic character, in the great width of the brain-case, in the short sagittal crest, in the slenderness of the muzzle, in the presence of prominent swellings on the forehead, and in the relative width of m^3.

Among foreign genera it suggests *Pronycticebus* but is excluded from this genus by the short sagittal crest and lack of interorbital swelling. Among living lemurs, such diverse types as *Myoxicebus, Propithecus, Perodicticus* resemble the present skull in some respects.

A lower jaw, Amer. Mus. 11481, from Grizzly Buttes, West (Lower Bridger), differs from all other Notharctidæ in having a very short third lobe, surmounted by only a single cusp. There is a bare possibility that this very peculiar type may belong with the skull of *Aphanolemur.*

Measurements of No. 11481.

	mm.
M_3 ap	5.5
M_{1-2}	10.5
M_{1-3}	16.2
M_1 ap. × tr	5.2 × 3.6

EXPLANATION OF PLATES.

Plate CIII.

Lower jaws of *Notharctus*, natural size.

Fig. 1. *Notharctus matthewi.* Lower jaw of type (left ramus, reversed), Amer. Mus. No. 12011; see page 847.

Fig. 2. *Notharctus osborni.* Lower jaw of type, Amer. Mus. No. 11466; see page 848.

Fig. 3. *Notharctus affinis.* Type of *Limnotherium affine*, Yale Univ. Mus. No. 11795; see page 850.

Fig. 4. *Notharctus tyrannus.* Type of *Limnotherium tyrannus*, Yale Univ. Mus. No. 11856; see page 851.

Fig. 5. *Notharctus tyrannus*, Amer. Mus. No. 11478; see page 851.

Fig. 6. *Notharctus tenebrosus*, U. S. Nat. Mus. No. 3752; see page 851.

Fig. 7. *Notharctus tenebrosus* (type of *Tomitherium rostratum*, reversed), Amer. Mus. No. 5009; see page 853.

Fig. 8. *Notharctus pugnax*, type, Amer. Mus. No. 1146 (left ramus reversed); see page 853.

Fig. 9. *Notharctus crassus.* Type of *Telmatolestes crassus*, Yale Univ. Mus. No. 11782; see page 854.

Plate CIV.

Lower teeth of *Notharctus*, twice natural size.

Fig. 1. *Notharctus matthewi*, type, left ramus reversed, Amer. Mus. No. 12011; see page 847.

Fig. 2. *Notharctus osborni*, type, Amer. Mus. No. 11466; see page 848.

Fig. 3. *Notharctus anceps* (lectotype of *Thinolestes anceps;* left ramus reversed), Yale Univ. Mus. No. 11786A; see page 849.

Fig. 4. *Notharctus anceps* (second cotype of *Thinolestes anceps;* p_4–m_3 left rereversed), Yale Univ. Mus. No. 11786B; see page 849.

Fig. 5. *Notharctus tyrannus*, Amer. Mus. No. 11478; see page 851.

Fig. 6. *Notharctus tyrannus*, Yale Univ. Mus. No. 11856; see page 851.

Plate CV.

Lower teeth of *Notharctus*, twice the natural size.

Fig. 1. *Notharctus affinis* (type of *Limnotherium affine*) Yale Univ. Mus. No. 11795; see page 850.

Fig. 2. *Notharctus tenebrosus* (type of *Tomitherium rostratum*), Amer. Mus. No. 5009; see page 853.

Fig. 3. *Notharctus tenebrosus*, type, U. S. Nat. Mus. No. 3752; see page 851.

Fig. 4. *Notharctus pugnax*, type, (left ramus reversed); Amer. Mus. No. 1146; see page 853.

Fig. 5. *Notharctus crassus* (type of *Hipposyus robustior;* left m_2 reversed), U. S. Nat. Mus. No. 3750, see page 855.

Fig. 6. *Notharctus crassus* (type of *Telmatolestes crassus*), Yale Univ. Mus. No. 11782; see page 854.

PLATE CVI.

Upper molars and premolars of *Notharctus*, twice natural size.

Fig. 1. *Notharctus matthewi*, p^3–m^1 of type, Amer. Mus. No. 12011; see page 847.

Fig. 2. *Notharctus anceps*, m^1–m^3 (left reversed) of type, Yale Univ. Mus. No. 11786A; see page 849.

Fig. 3. *Notharctus anceps*, p^1–p^4 of type, Yale Univ. Mus. No. 11786A; see page 849.

Fig. 4. *Notharctus anceps* (*?*), p^3–m^3 of second cotype, Yale Univ. Mus. No. 11786B; see page 849.

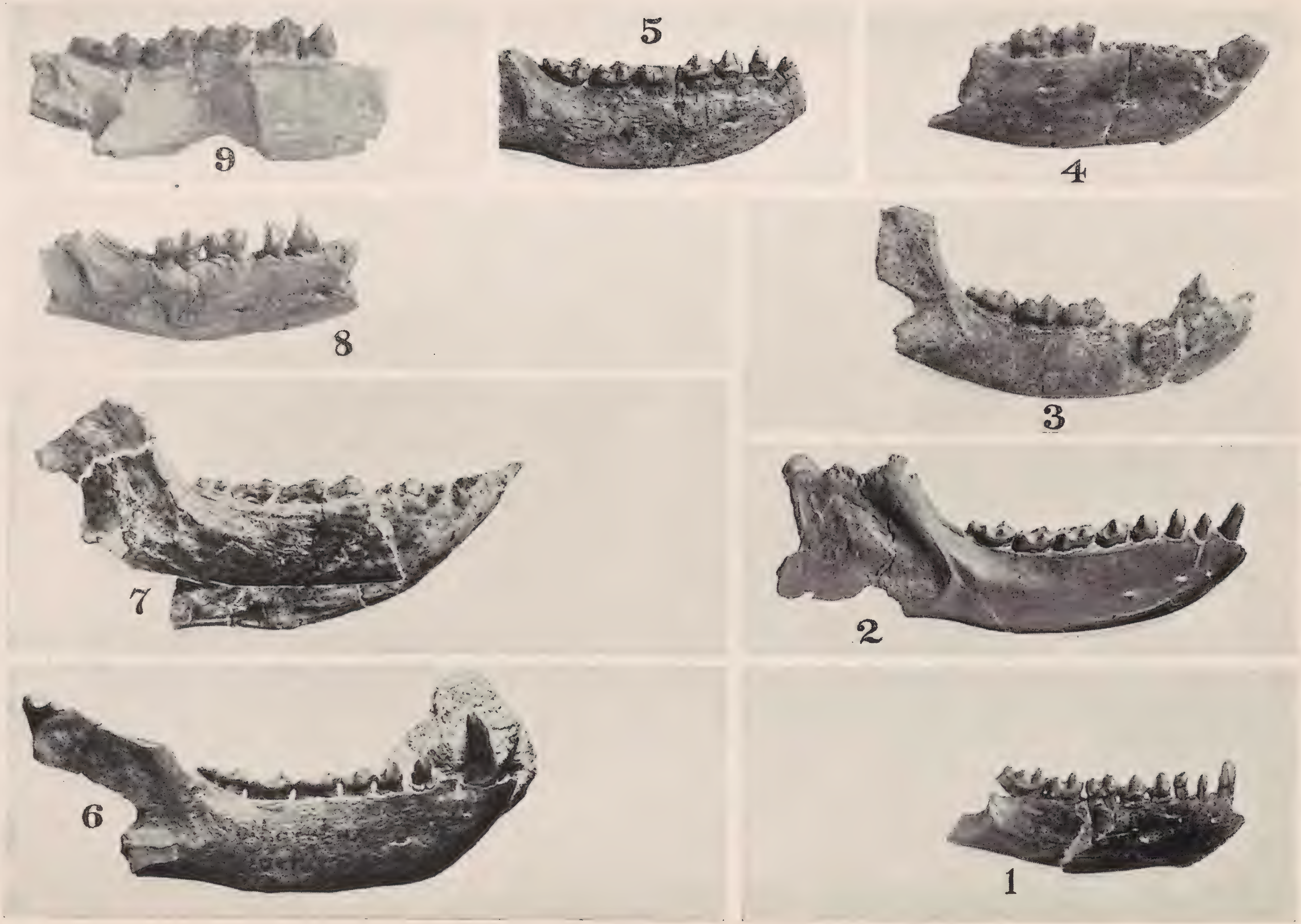
Fig. 5. *Notharctus affinis*, p^3–m^2 (left reversed) of type, Yale Univ. Mus. No. 11795; see page 850.

Fig. 6. *Notharctus tenebrosus*, m^1, m^2 and part of m^3, left reversed (type of *Hipposyus formosus*), U. S. Nat. Mus. No. 3757; see page 852.

PLATE CVII.

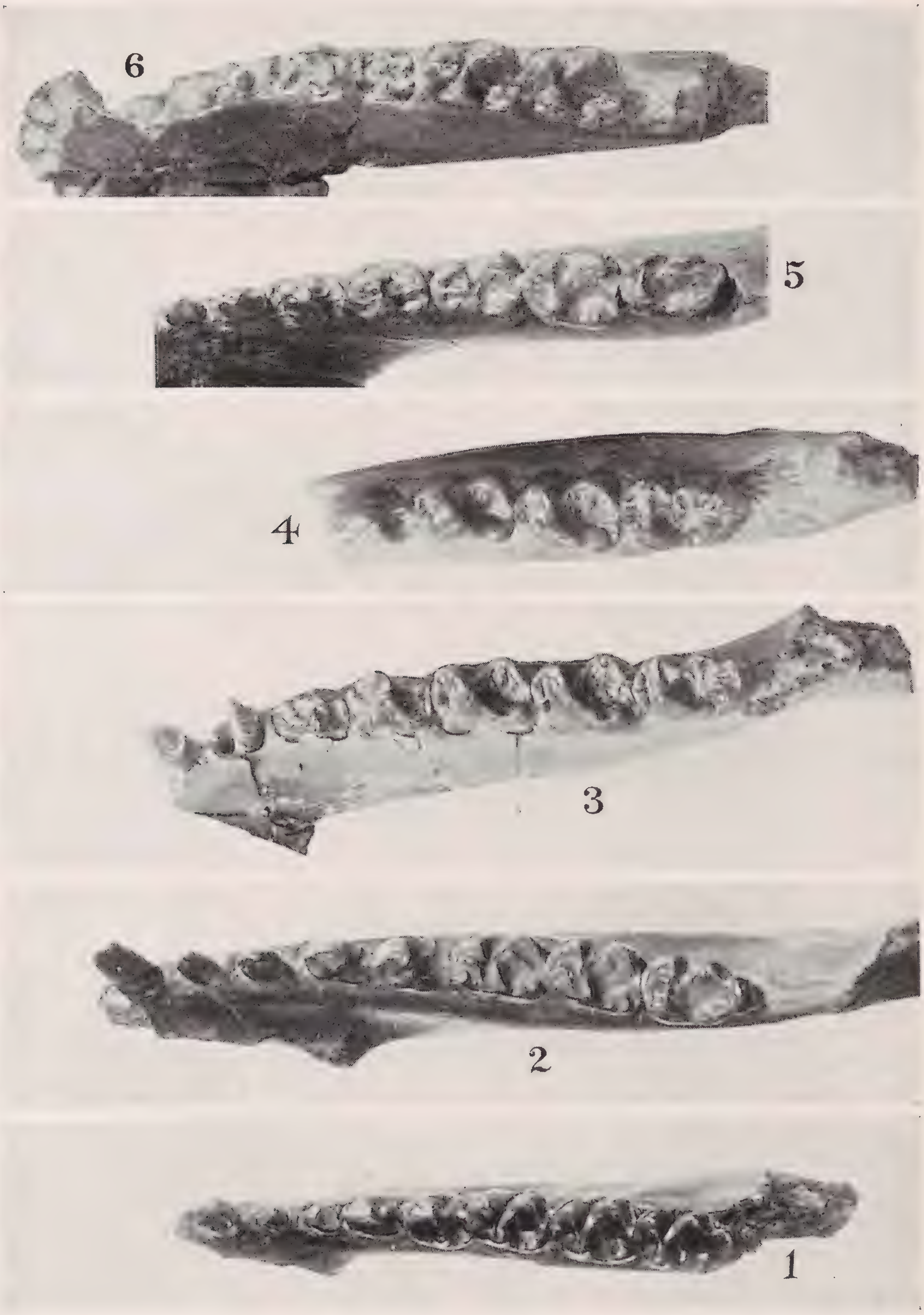
Aphanolemur gibbosus, type skull. Yale Univ. Mus. No. 12152. Natural size. See page 856.

Fig. 1. Left side. 2. Occipital view. 3. Top view. 4. Under side.



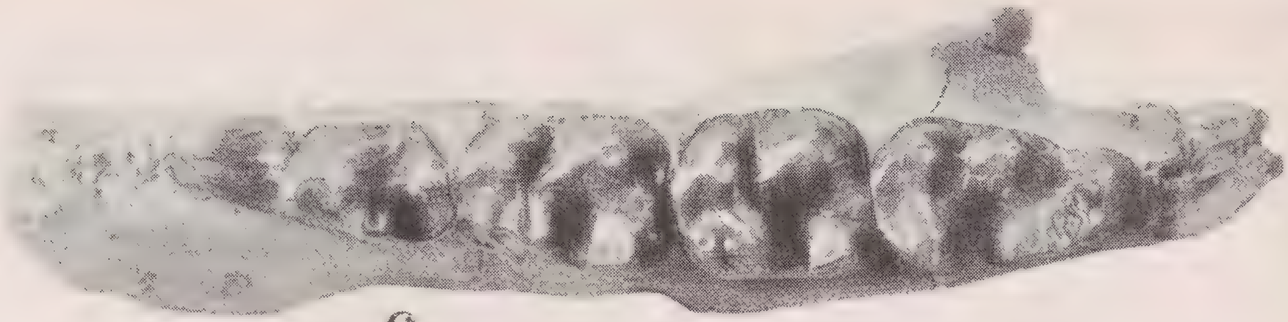
1. Notharctus matthewi.
2. “ osborni
3. Notharctus affinis.
4. “ tyrannus
5. Notharctus tyrannus.
6, 7. “ tenebrosus.
8. Notharctus pugnax.
9. “ crassus.

$\times \frac{1}{1}$.

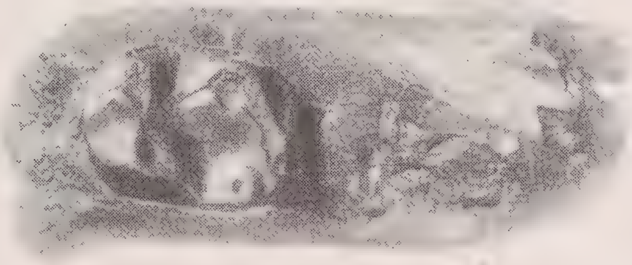


1. Notharctus matthewi.
2. “ osborni.
3. “ anceps.
4. Notharctus anceps.
5. “ tyrannus.
6. “ tyrannus.

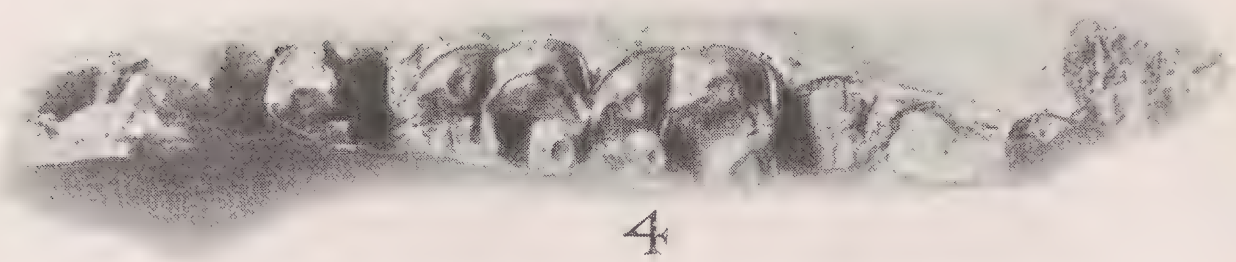
× $\frac{2}{1}$.



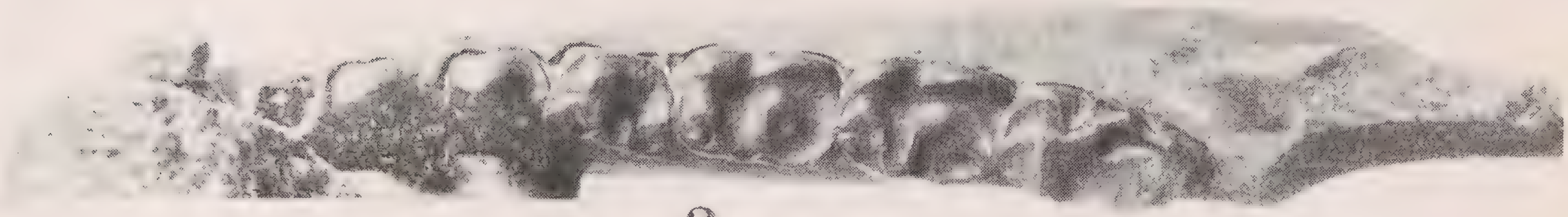
6



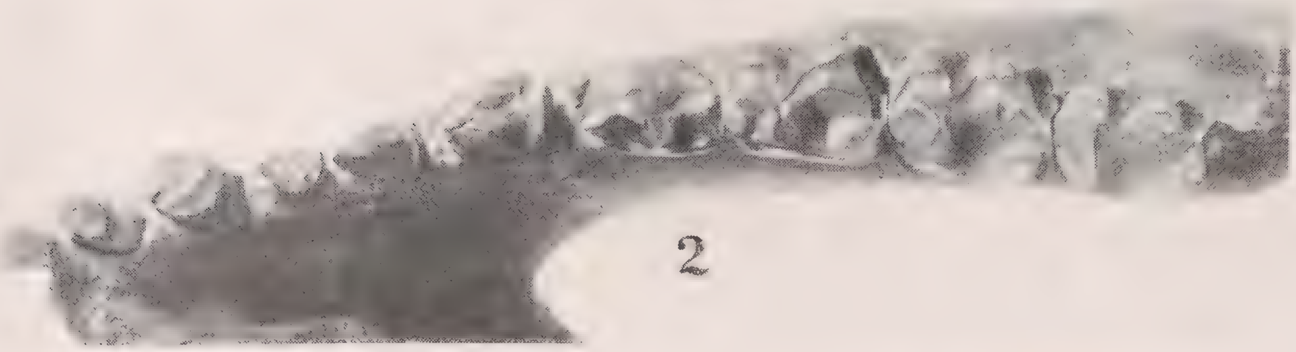
5



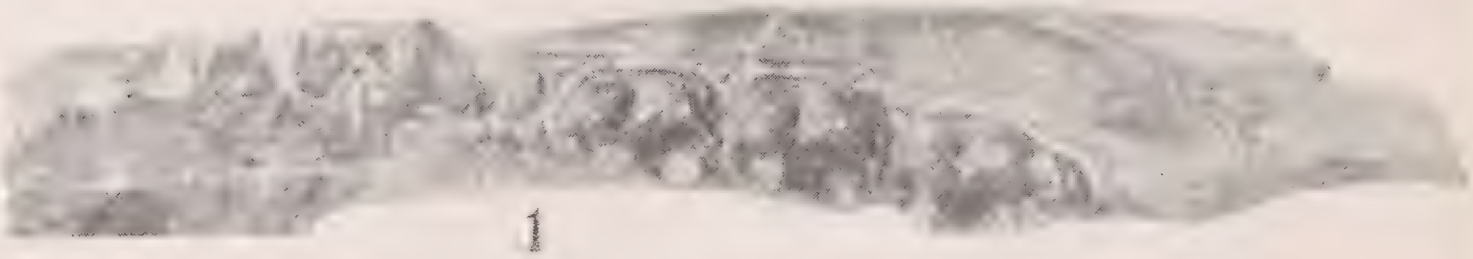
4



3



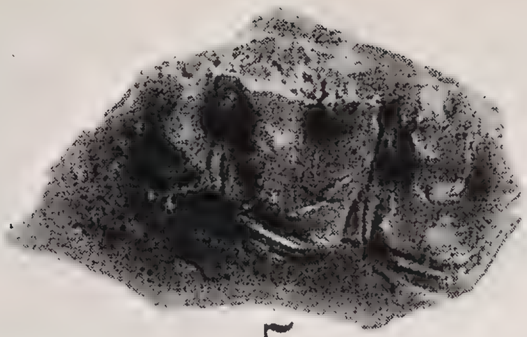
2



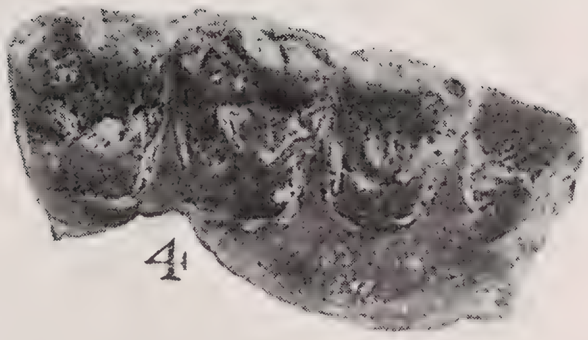
1

1. Notharctus affinis.
2. " tenebrosus.
3. " tenebrosus.
4. Notharctus pugnax.
5. " crassus.
6. " crassus.

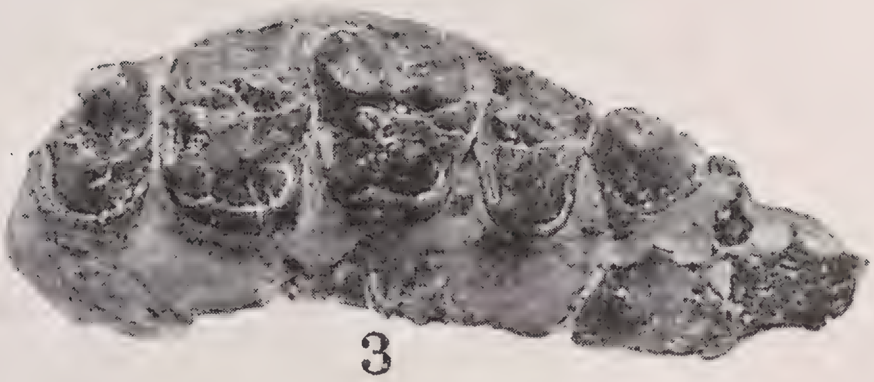
× $\frac{2}{1}$.



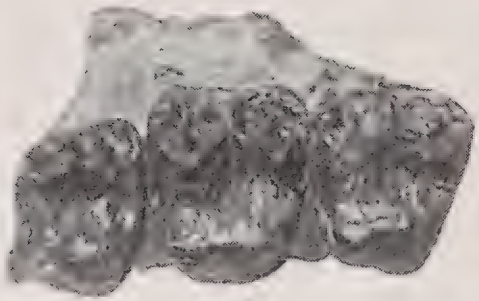
5



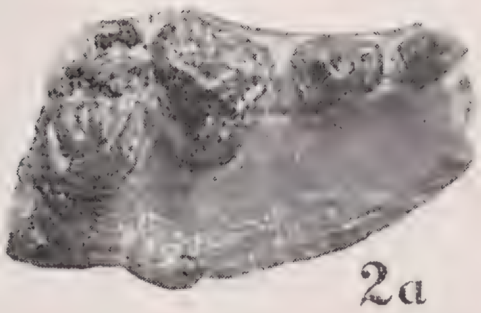
4



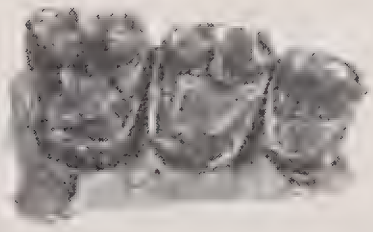
3



2



2a

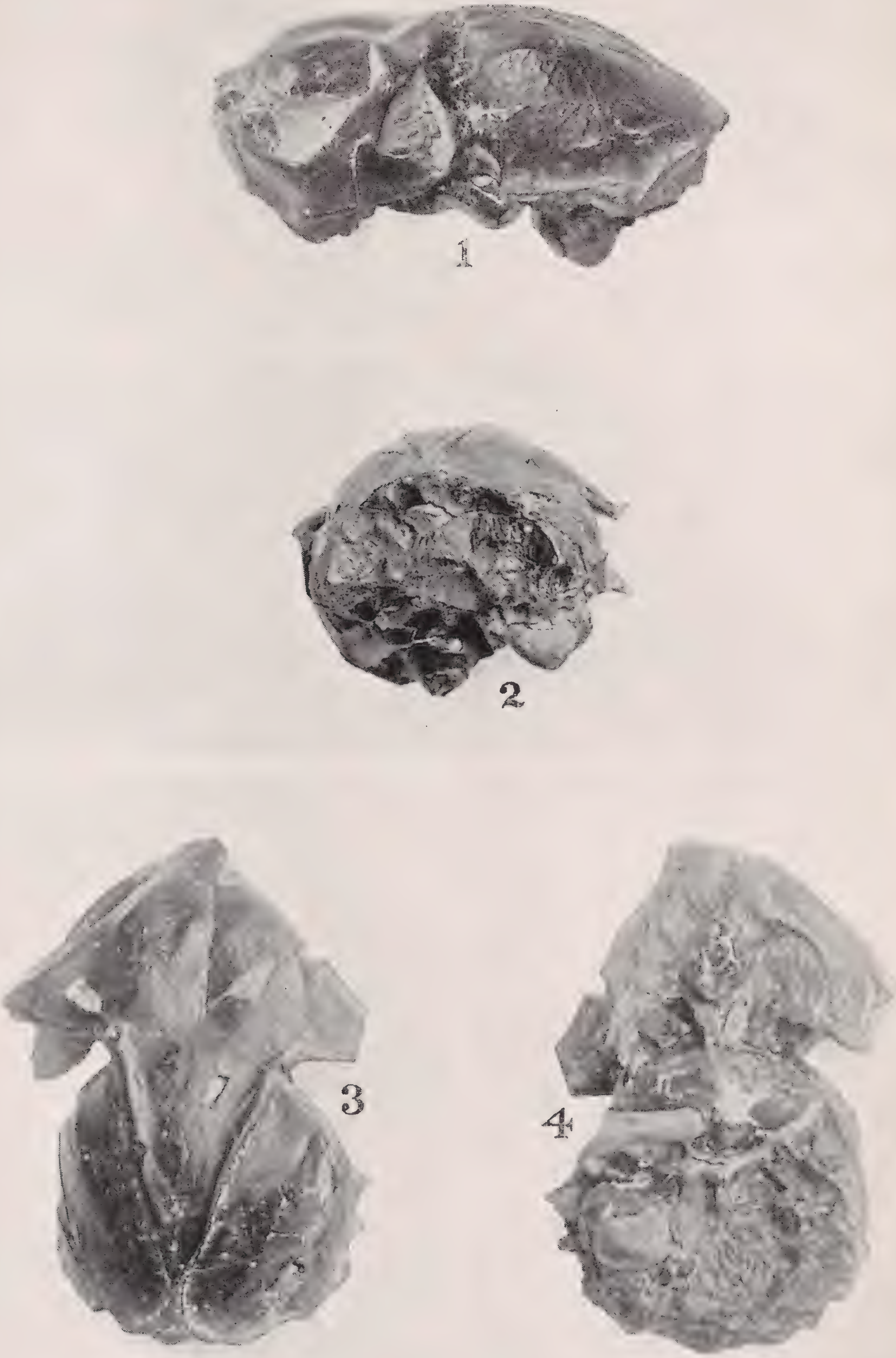


1

1. Notharctus matthewi.
2. “ anceps.
2a. “ anceps.

3. Notharctus (?) anceps.
4. “ affinis.
5. “ tenebrosus.

$\times \frac{2}{1}$.



Aphanolemur gibbosus, type. × $\frac{1}{1}$.

59.84,2D(83)

Article XXXV.— A NEW ALBATROSS FROM THE WEST COAST OF SOUTH AMERICA.

Contributions from the Brewster-Sanford Collection.[1]

By Robert Cushman Murphy.

Mr. John T. Nichols, of the American Museum of Natural History, has kindly brought to my attention an apparently undescribed albatross in the Brewster-Sanford Collection. The type and only specimen was collected about forty miles off the coast of Chile, by Mr. Rollo H. Beck, who informs me that he did not, at the time of the capture, distinguish the bird from an example of *Diomedea exulans* taken with it.

In size the new species belongs with the group of major albatrosses, but the absolute lack of vermiculations on the extensive white areas of its plumage distinguishes it sharply from *Diomedea exulans* or its allies, and, indeed, from all of the larger albatrosses excepting possibly *Diomedea epomophora.* Furthermore, the formation of the narial tubes and apertures differs sufficiently from that in any known albatross to warrant, in my opinion, the erection of a new subgenus of *Diomedea.*

Rhothonia[2] subgen. nov.

Naricorn rotund and bulging, the tubes much more prominent than in subgenus *Diomedea;* nostrils circular in outline, and directed forward instead of obliquely upward; culminicorn obtusely pointed posteriorly.

Diomedea (Rhothonia) sanfordi[3] sp. nov.

Char. sp.— Bill shorter and narrower than in the *D. exulans* group, with a less strongly hooked unguis; no trace of bars or vermiculations on any part of plumage, which is whiter than that of other members of the genus.

---

[1] This is the first of a series of papers on the collection of marine birds which Mr. Rollo H. Beck has secured for Mr. Frederick F. Brewster and Dr. L. C. Sanford, chiefly off the coasts of southern South America. The collection is deposited in the American Museum where, through the generosity of its owners, it forms a part of the material available for research. Mr. Robert Cushman Murphy, Curator of the Department of Natural Science, of the Brooklyn Museum, whose explorations in the subantarctic have given him an opportunity to meet in life many of the birds secured by Mr. Beck, has been requested to prepare the reports on the Brewster-Sanford Collection.— Frank M. Chapman, Curator of Birds, American Museum of Natural History.

[2] ῥώθωνες, the nostrils.

[3] I take pleasure in naming this handsome bird in honor of Dr. Leonard C. Sanford, whose ornithological enthusiasm has led to the assembling of an unique collection of South American water birds.

Type.— No. 1418, Brewster-Sanford Coll., ♀ adult; Oct. 22, 1913; at sea, 40 miles off Corral, Chile; R. H. Beck.

Range.— Known only from the type locality.

Description of Type.— Head, back, tail, entire under surface, and flanks, white without a trace of wavy bars; a few feathers with dusky shafts and terminal blotches on interscapulum and lower flanks, and a few irregular brownish spots near tip of tail; scapulars grayish-brown, narrowly edged with whitish; wings blackish-brown, blending into clove-brown toward the anterior border; base of primaries white, especially on the inner webs, the shafts of the outer quills cream-colored except at their tips; lining of wing white with a dark margin; "iris brown; bill fleshy white, tip creamy; feet grayish white; ovaries minute, non-breeding" (R. H. B.). Measurements in millimeters; wing, 612; tail, 185, tarsus, 115; middle toe and claw, 152; exposed culmen, 150.

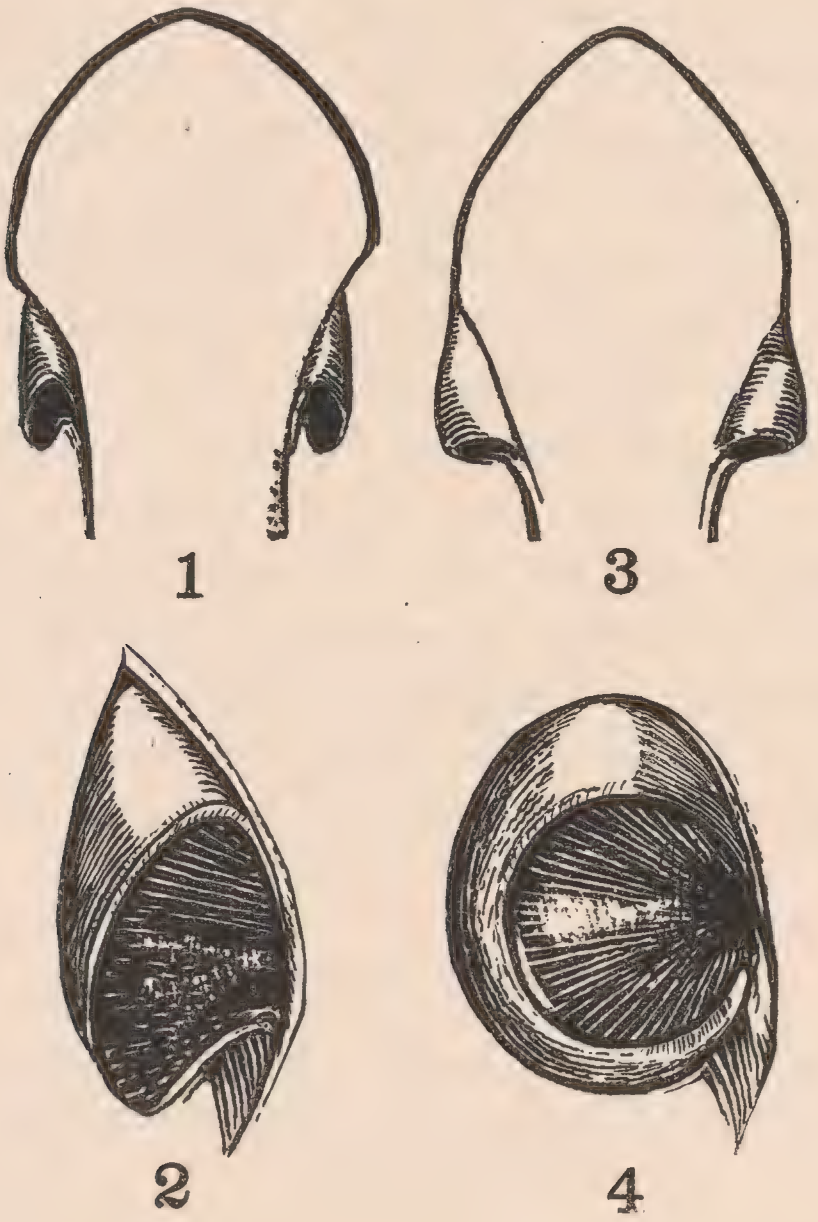


Fig. 1. Superior view of culminicorn and narial tubes of *Diomedea exulans*. 2. Anterior view of right narial tube of *D. exulans*. 3, 4. The same structures and aspects in *D. sanfordi*.

Remarks.— Since the type specimen of *D. sanfordi* is very evidently an old female in unworn plumage, I have compared it with an equally mature female of *D. exulans*, taken at the same locality and on the same date. My experience with the latter species on its breeding grounds at South

Georgia has shown that there are marked sexual distinctions among fully adult birds, the males being larger in most dimensions as well as more nearly immaculate in coloration.

Comparative measurements.

	Exposed culmen	Breadth of culminicorn between nostrils	Greatest width of unguicorn	Width of maxilla at gape
D. sanfordi ♀ ad. Brewster-Sanford Coll. 1418.	150	15.5	14	40
D. exulans ♀ ad. Brewster-Sanford Coll. 1417.	158	19.5	16.4	43.5

	Wing (from carpal joint)	Length of ulna (mid-wing)	Tail	Tarsus	Middle toe and claw
D. sanfordi ♀ ad. Brewster-Sanford Coll. 1418.	612	410	185	115	152
D. exulans ♀ ad. Brewster-Sanford Coll. 1417.	577	427	188	112.5	162

The figures in the first four columns demonstrate that *sanfordi* has a distinctly weaker bill than *exulans*. The diagnostic characters of the narial tubes are illustrated by the accompanying sketch. To this I may add that in *sanfordi* the lumen of the tube runs straight backward so that it may be followed with the eye for a considerable distance when viewed from directly in front. In *exulans*, on the other hand, the course of the tunnel is sharply toward the mid-line, so that only the lateral wall is visible from the front.

The usual wing dimensions, if considered alone, would be somewhat misleading, for the wing (manus) of *sanfordi*, with fresh, unworn remiges, is actually longer than that of a wandering albatross in practically the same condition of plumage. Comparative measurements of the mesial segment (ulna) give a truer conception of the probable relation in size of the two species, for *exulans* is doubtless a larger bird than *sanfordi,* with a wider expanse (tip to tip), and greater weight of body. It is interesting in this connection to note that in the folded wing of *exulans* the tips of the primaries fall short of the tips of the secondaries, while in *sanfordi* the primaries extend beyond the secondaries.

The type of *sanfordi* shows no trace of the white olecronal patch which is so conspicuous a mark on the wing of *exulans* and its allies.

As regards coloration, it is at least highly improbable that the plumage of this very white albatross is marked with undulating bars at any age.

59.51,22C

Article XXXVI.— A NEW SPECIES OF TREMATODE (*CLADORCHIS GIGAS*) PARASITIC IN ELEPHANTS.[1]

By G. A. MacCallum, M. D.

Plates CVIII–CX.

The material brought to the Museum from the Belgian Congo comprised a large number of parasites from the various mammals, birds, fish, etc., which were met with by Messrs. Lang and Chapin during their stay of nearly six years in that country. It is representative of a very extensive tropical fauna, as the collectors were most energetic and industrious in their endeavors to make as large a collection as possible. I wish here to thank the curators of the Department of Invertebrate Zoölogy at the American Museum of Natural History for their great kindness in entrusting this valuable collection to me for identification and study. Where so many unusual forms are found with so little literature to assist, the determination of the species will naturally be rather tentative.

Several specimens of the African elephant (*Loxodon africanus* Blum.) were autopsied. Little has been written about the Entozoa of this species, which apparently differ in many respects from the better known forms infecting *Elephas indicus*.

It is said that elephants succumb to the infestation of parasites more than from any other cause and the worm most often responsible for the destruction of these animals is a species of *Paramphistomum*. Numbers of this genus of trematodes are commonly parasitic among the herbivora in tropical countries and often infest the stomach and intestines in great numbers so as not only to deplete the animal by the great quantity of blood extracted but also to disturb the lining membrane of the stomach and intestine so as to interfere seriously with the secretions and digestion. It may be said that several species of worms are often found living in the same region.

The elephant when suffering from unusual numbers of these parasites is said to make instinctively an attempt to get rid of them and in order to do so it will eat ten or twenty pounds of a certain red earth when it can be found. This acts as a purgative and thus a lot of worms are dislodged and expelled. In India, with domesticated herds of four or five hundred of these valuable animals, the loss from Entozoa is sometimes serious. "The usual remedy given to domesticated elephants is a solution of Kallahmimok or 'bit noben,' 4 oz. to as many gallons of water. This is one of the best remedies and is said to be an impure chloride of sodium containing a little sulphuret of iron. It is a purgative and is claimed to be quite efficient, the good effects lasting some time." (Cobbold.)

---

[1] Scientific Results of the Congo Expedition. Invertebrate Zoölogy, No. 2.

Family PARAMPHISTOMIDÆ, Fischoeder.

Subfamily Cladorchinæ, Fischoeder.

Genus **Cladorchis** *Fischoeder*.

I have recently published an exhaustive discussion of the nomenclature of the Paramphistomidæ and a revision of the described species.[1] Some additional species are: *Cladorchis pangasii* in *Pangasius nasutus*, a siluroid fish from Sumatra, and *Cladorchis helostomatis* in the stomach of *Helostoma temmincki*, a fish from Palembang, Sumatra; both species described by Dr. W. G. MacCallum.[2] Also two species from turtles: *Paramphistomum papillostomum* G. A. MacCallum,[3] in the colon of a very large *Chelonia mydas* from Key West, Florida; *Paramphistomum aspidonectes* G. A. MacCallum,[4] found in 1916 in the oviduct of *Trionyx spinifer*.

However, in 1901 Fischoeder [5] published a revision of the Amphistomes and in this he divided them into two great groups, *viz.*, those with pharyngeal cæca (Cladorchinæ) and those without such appendages (Paramphistominæ). The former subfamily only interests us here; he describes them as having a ventral acetabulum at the posterior end, two pharyngeal pockets present, testicles branched, vas deferens without pars musculosa, cirrus pouch present and the body slightly flattened dorso-ventrally. The body has an anterior conical portion; the disc is concave and the acetabulum small. This diagnosis would include such genera as *Gastrodiscus, Cladorchis,* etc. A parasite described as *Amphistomum,* but probably belonging to the genus *Gastrodiscus* Fischoeder, 1901, selects at times even man as host.

---

[1] Zoopathologica, I, 1, 1916, p. 31.

[2] On two new Amphistoma parasites of Sumatran fish. Zool. Jahrb. Syst., XXII, 1905, p. 667.

[3] Zoopathologica, I, 1, 1916, pp. 31–33, fig. 13.

[4] Zoopathologica, I, 2, 1917, pp. 59–60, fig. 26.

[5] Die Paramphistomiden der Säugethiere. Zoolog. Anzeiger, XXIV, 1901, pp. 367–375.

Cladorchis gigas sp. nov.

According to Lang this worm is very common in the stomachs of elephants which he had the opportunity of examining. Consequently many specimens are found in the collection, from the northeastern Uele: Vankerckhovenville, Faradje, and Yakuluku. It is very different from any of the Cladorchinæ described from the Indian Elephant: *Pseudodiscus hawkesii* (Cobbold), *P. ornatus* (Cobbold), and *Pfenderius papillatus* (Cobbold).[1]

This parasite must be classed under the genus *Cladorchis* and is probably the largest member of the group yet discovered. Consequently it will be named *Cladorchis gigas.* (See Plate CVIII, Figs. 1 and 2.) It was found in great numbers in the stomach and intestine of *Loxodon africanus.* It is pinkish white in color, quite pointed at the anterior end where the mouth is subterminal. The most striking feature however is the presence of two relatively large wings or claspers on each side of the caudal sucker. These claspers are very muscular and strong and are a quarter or one third of the length of the worm. They are probably used by the worm in clearing a space for the caudal sucker to act, since the stomach of the elephant is usually coated throughout, above the mucous membrane, with a very sticky, pasty tenacious layer of mucus about a quarter of an inch deep, which is said by those who have tried, to be exceedingly difficult to clear away. When a worm is detached, however, a circular patch white and smooth is left where the sucker was adherent to the mucous membrane.

Looking at the worm ventrally the mouth is the most anterior opening, then about nine millimeters posteriorly is seen the large genital pore. This is at about the middle of the ventral surface, still further posteriorly and situated between the anterior ends of the claspers is the large ventral or caudal sucker. The ventral surface is not concave as would have been expected but is rather convex, being bulged out as it were by the contents of the abdomen, largely by the immense single testis. Dorsally the body is very convex evenly from the back of the head to the terminal ends of the claspers or alæ. These latter are however divided at the posterior ends, separating them into two, almost up to the ventral sucker, much as in *Amphistomum bicaudatum* (Baird). Indeed this parasite in its external characters is very much like *C. gigas* except in size, as it was said by Baird to measure 6 mm. long × 5 mm. wide, wings 2 mm. long and the ventral sucker 1 mm. in diameter and to have two testicles placed one on each side against the inner side of the intestine. It is therefore different from *C. gigas*, the exact measurements of which are given on p. 870.

---

[1] See T. S. Cobbold, Trans. Linn. Soc. London, (2), Zool., II, pt. 4, 1882, pp. 238–242.— L. Gedoelst, Synopsis de Parasitologie, 1911, pp. 88–89.

Plate CVIII, Fig. 3, and Plate CIX show the anatomy of *C. gigas* and illustrate the internal arrangement of its organs as well as its histological structure. The worm was so thick that it was necessary to make four hundred and thirty or more serial sections in the sagittal plane. In Plate CX a reconstruction of these sections is shown and proves a most interesting study. As will be seen here the mouth is relatively small near the tip of the triangular anterior portion of the body opening into a very powerful muscular mouth sucker and behind this there is a stout muscular pharynx from which there opens on each side a large cæcum. The cæca fill almost entirely this portion of the body. The pharynx is continued between these into the œsophagus. This shortly ends in the intestine which here branches into the cœca. The latter are large and convoluted and pass along the sides back as far as the anterior end of the alæ. In the angle of the intestinal cæca appears the genital pore. This may be seen to open into an exceedingly large circular cirrus sac. This is a very peculiar arrangement which encloses the cirrus, vesicula seminalis, ductus ejaculatorius, and vas deferens. It also encloses a part, the terminal portion of the uterus, the metraterm. The cirrus has a well developed muscular prostatic portion and the uterine metraterm is well developed.

As will be seen in the reconstructed worm, immediately beneath the anterior wall of the abdomen is the immense deeply lobulated or branched single testis which sends an arm or prolongation toward the cirrus sac before the real vas deferens is given off. Here too it may be noted that in the first portion of the vesicula seminalis, masses of the sperm forming cells have been forced where they do not usually appear.

The actual copulatory part of the apparatus seems to be the thick muscular sac with folded walls which projects into a broad tube which opens externally — a sort of vagina. This muscular sac receives both the cirrus and the end of the uterus, the uterine opening being just behind that of the prostatic part of the cirrus.

On tracing back the uterus in which eggs are to be seen it is found to pass in a curve backward to the posterior wall of the sac where it becomes very narrow and thick-walled and passes in a slanting direction through the wall to extend in free coils posteriorly. The point of penetration is ventral to the entrance of the vas deferens. Thus there is a very large sac with very dense fibrous walls through which both uterus and vas deferens enter posteriorly, the uterus to pass directly to the muscular sac which opens into the external cloaca, the vas deferens to enter a thin-walled seminal vesicle which passes by a stouter walled prostatic portion to the same sac into which it opens side by side with the uterus.

Within the sac these organs are suspended in a very peculiar tissue which seems to be made of spongy anastomosing strands of fibre cells and in the meshes of which there are great accumulations of some thick fluid which is coagulated. The vas deferens approaches the sac rather dorsally from behind and is seen as a very wide convoluted tube full of a fluid mixture of spermatozoa and cell complexes from the testicle. This gives it the appearance of being a prolongation or arm of the testis. It suddenly narrows or gives off a small tube which passes through the wall of the cirrus sac in the dorsal median line in a long slant to join the convoluted seminal vesicle, the distal part of which may be called the ductus ejaculatorius. The posterior convolution of the seminal vesicle still shows some of the mulberry-like sperm-forming cells and numerous clusters of the forerunners of spermatozoa. As it proceeds however the contents become pure spermatozoa. It passes forward and in the anterior part of the cirrus sac becomes narrowed to a valve-like constriction as it enters the prostatic part. This is a long broad tube bent once which runs to enter the muscular portion of the cirrus sac by a narrow opening. It is lined with ciliated cells and thickly surrounded by a mass of rather large pear-shaped cells arranged with thin pointed ends toward the lumen. There is also a good deal of muscle in the wall. There are some large pale granular cells interspersed with the others which somewhat resemble the parenchyma cells.

Lying dorsally to the testis and to the right is the semilunar shaped ovary and close against it, with a very short oviduct between, is the shell gland which on account of its size is very beautifully shown with the oviduct entering it to form the oötype. Arising therefrom or terminating in it is plainly seen Laurer's canal passing dorsally to open in the centre of the back. The uterus of course arises or begins outside of the shell gland and in this case is voluminous and lobulated, occupying a large portion of the body cavity. The vitellaria are found to be chiefly situated in the alæ although some lobules are to be seen in a small portion of the body posteriorly. The vitelline ducts from these glands pass forwards and inwards, join and enter the oviduct just before that tube enters the shell gland (Fig. 1).

The ventral sucker is a wonderfully constructed, muscular organ, much like that of smaller trematodes but here it is on such a large scale that it can be studied to advantage as a type. The muscular fibres are plainly shown and are a study in themselves. There are seen here many circular muscular fibres, radial muscular fibres and also longitudinal fibres, and interspread between these many muscle cells, the whole forming a very powerful organ.

The water-vascular system is well developed, the whole concentrating in a large reservoir or bladder with a free outlet at the posterior portion in the center of the back and a short distance posterior to the inlet of Laurer's canal. Large portions of the reservoir are shown in the sections and show even the small mucous papillæ on its surface.

The eggs are large and numerous; they are round and appear to be filled with vitelline granular matter, etc.

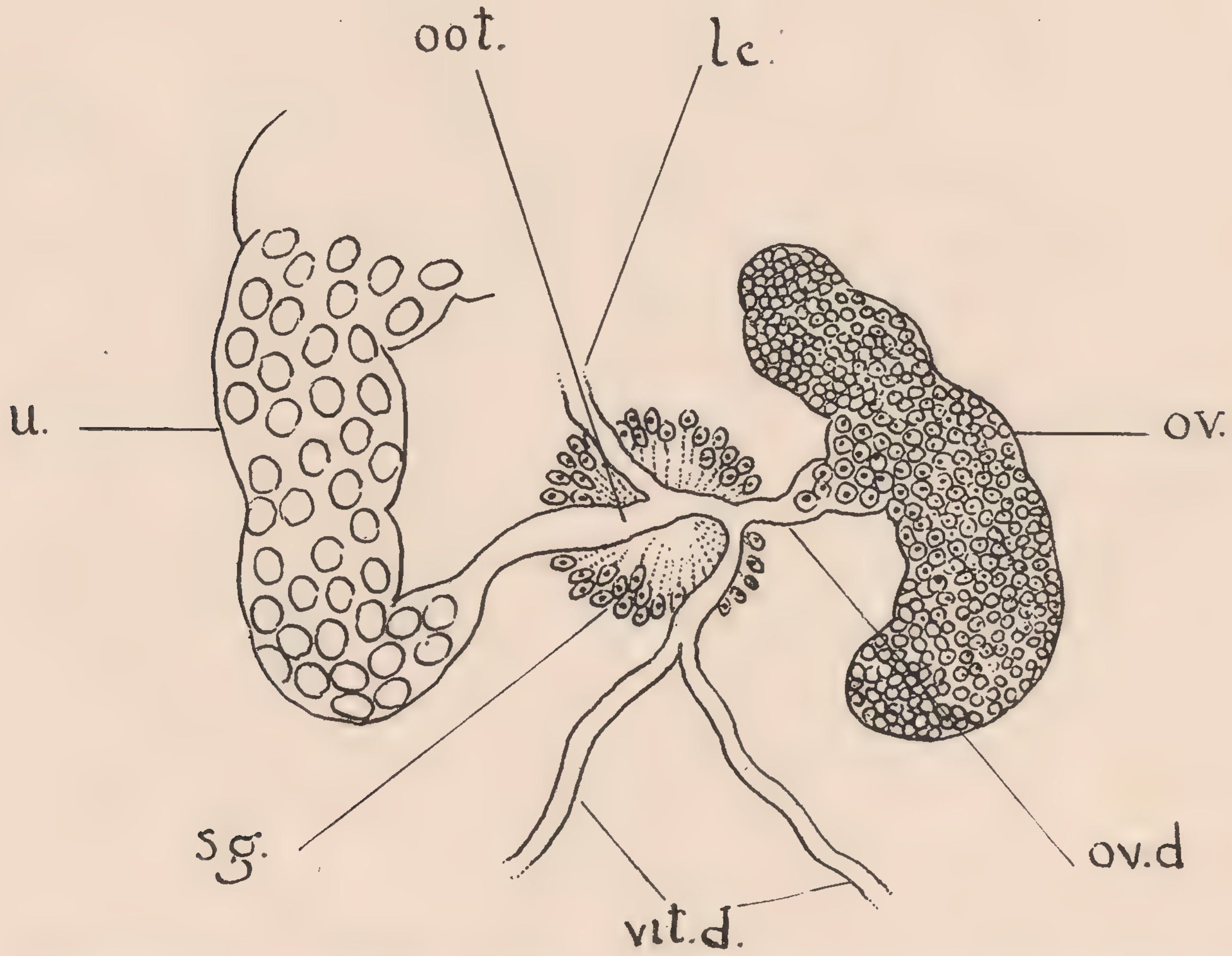


Fig. 1. *Cladorchis gigas* sp. nov. Details of female reproductory organs. Abbreviations as on plates (see p. 871).

The nervous system consists of a somewhat horseshoe-shaped ganglion situated dorsal to the pharyngeal cæca, from which nerve trunks are sent posteriorly and along each side to supply the body generally.

Measurements of *Cladorchis gigas*.

	mm.
Length	21
Width	10
Diameter of ventral sucker or acetabulum	2
Between genital pore and ant. margin of acetabulum	5
Length of claspers or alæ	9
Width of claspers or alae	5
Antero-posterior depth of body	6

EXPLANATION OF PLATES CVIII–CX.

Abbreviations.

al. — alæ or claspers.
c. — cirrus.
ce. — cæcum.
cl. — cloaca.
c.s. — caudal sucker.
d.ej. — ductus ejaculatorius.
ex.p. — excretory pore.
g.p. — genital pore.
i. — intestine.
l.c. — Laurer's canal.
m. — mouth.
met. — metraterm.
m.s. — muscular mouth sucker.
oot. — oötype.
ov. — ovary.
ov.d. — oviduct.
ph. — pharynx.
p.p. — pars prostatica.
res. — water-vascular reservoir.
s.g. — shell gland.
s.v. — seminal vesicle.
t. — testis.
u. — uterus.
v.d. — vas deferens.
vit. — vitellaria.
vit.d. — vitelline duct.
v.s. — ventral sucker or acerabulum.

Plate CVIII.

Cladorchis gigas sp. nov. Fig. 1. Side view. $\frac{3}{1}$. Fig. 2. Ventral view. $\frac{3}{1}$. Fig. 3. Section through the cirrus sac, showing details of reproductory organs, especially the peculiar cloaca with vagina-like portion. $\frac{25}{1}$.

Plate CIX.

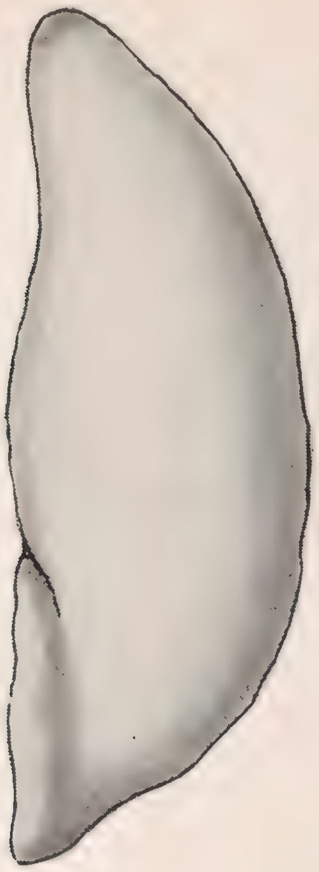
Cladorchis gigas sp. nov. Sagittal section. $\frac{9}{1}$.

Plate CX.

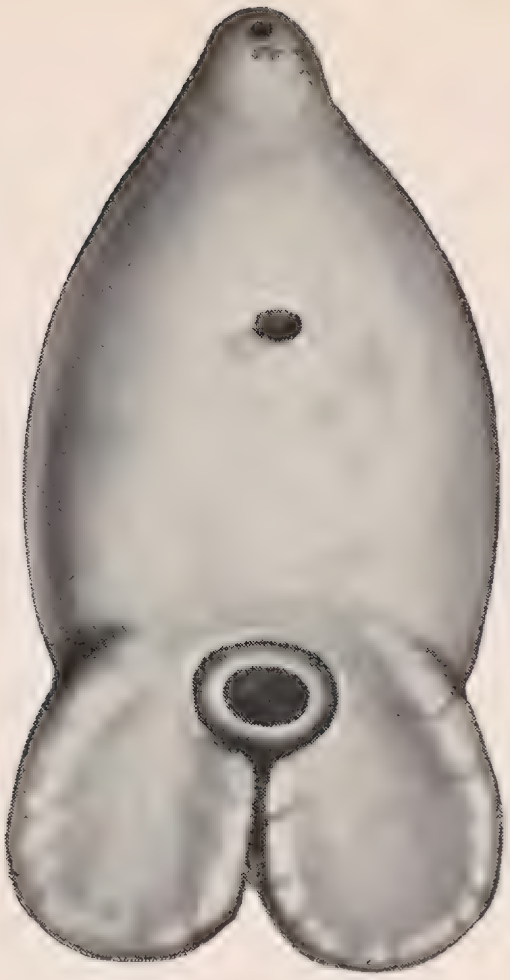
Cladorchis gigas sp. nov. Ventral view. Reconstruction of the internal anatomy after serial sections. $\frac{8}{1}$.

Text Figure.

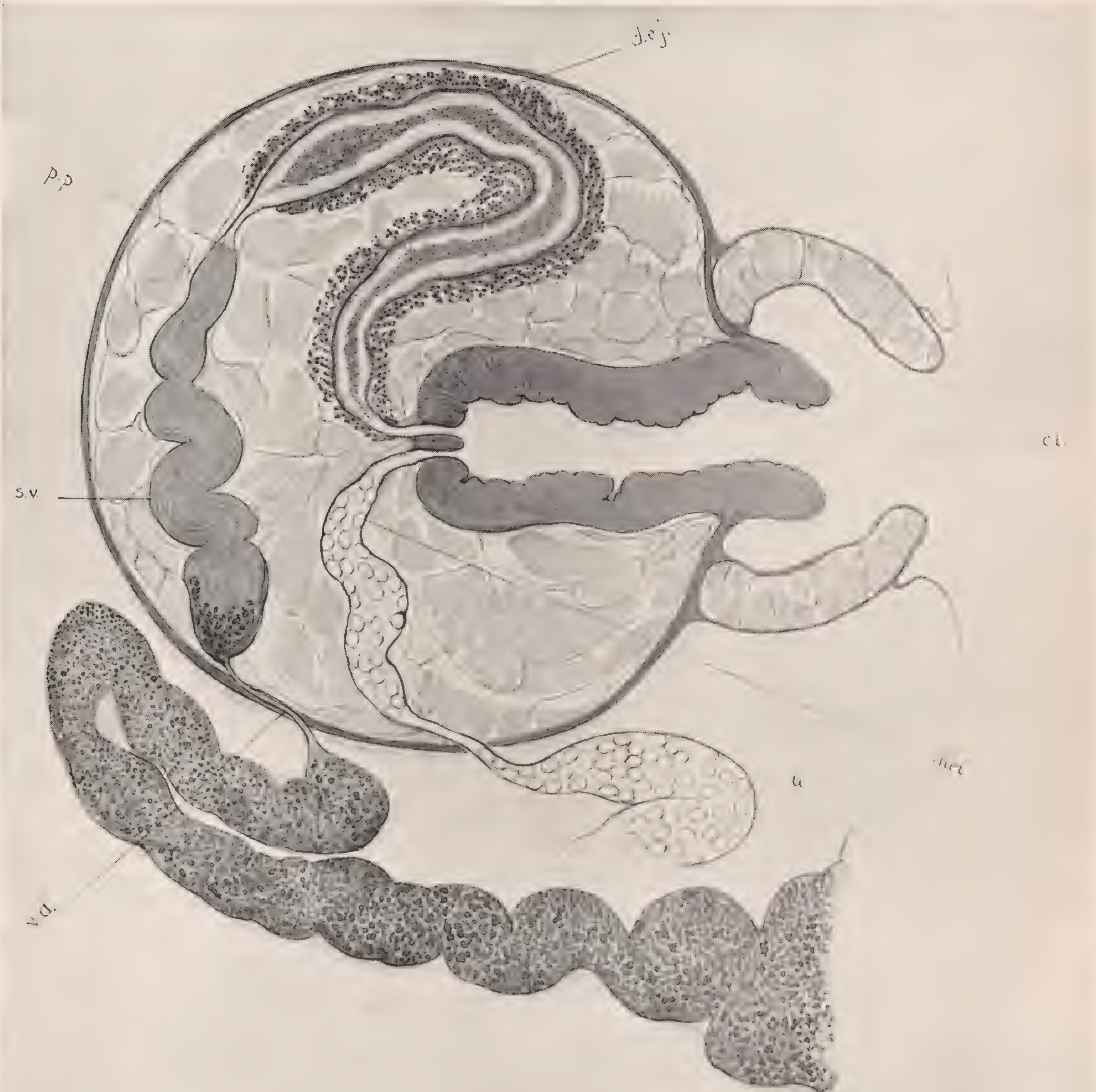
Fig. 1. *Cladorchis gigas* sp. nov. Details of female reproductory organs. Abbreviations as on plates.



1

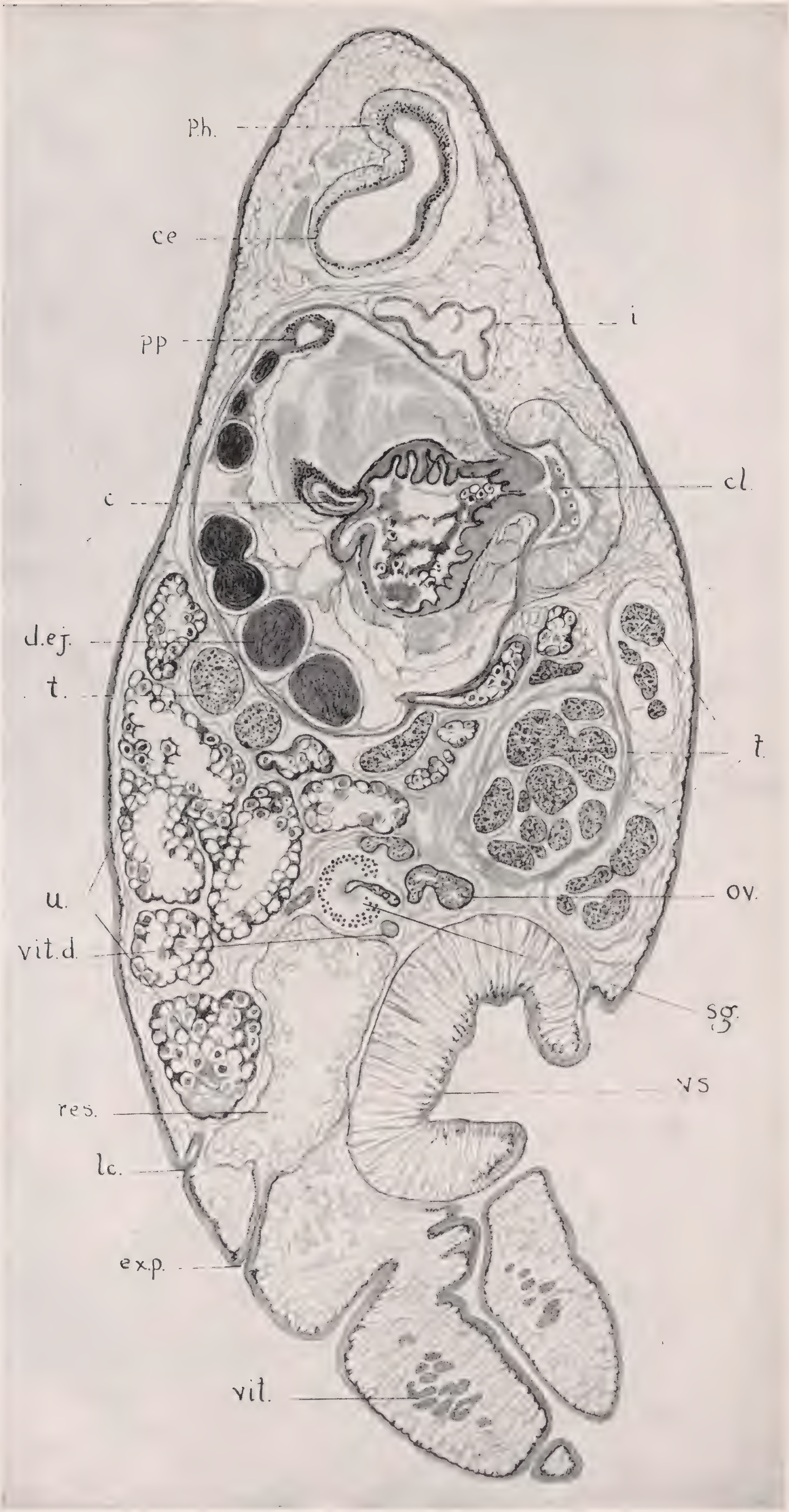


2

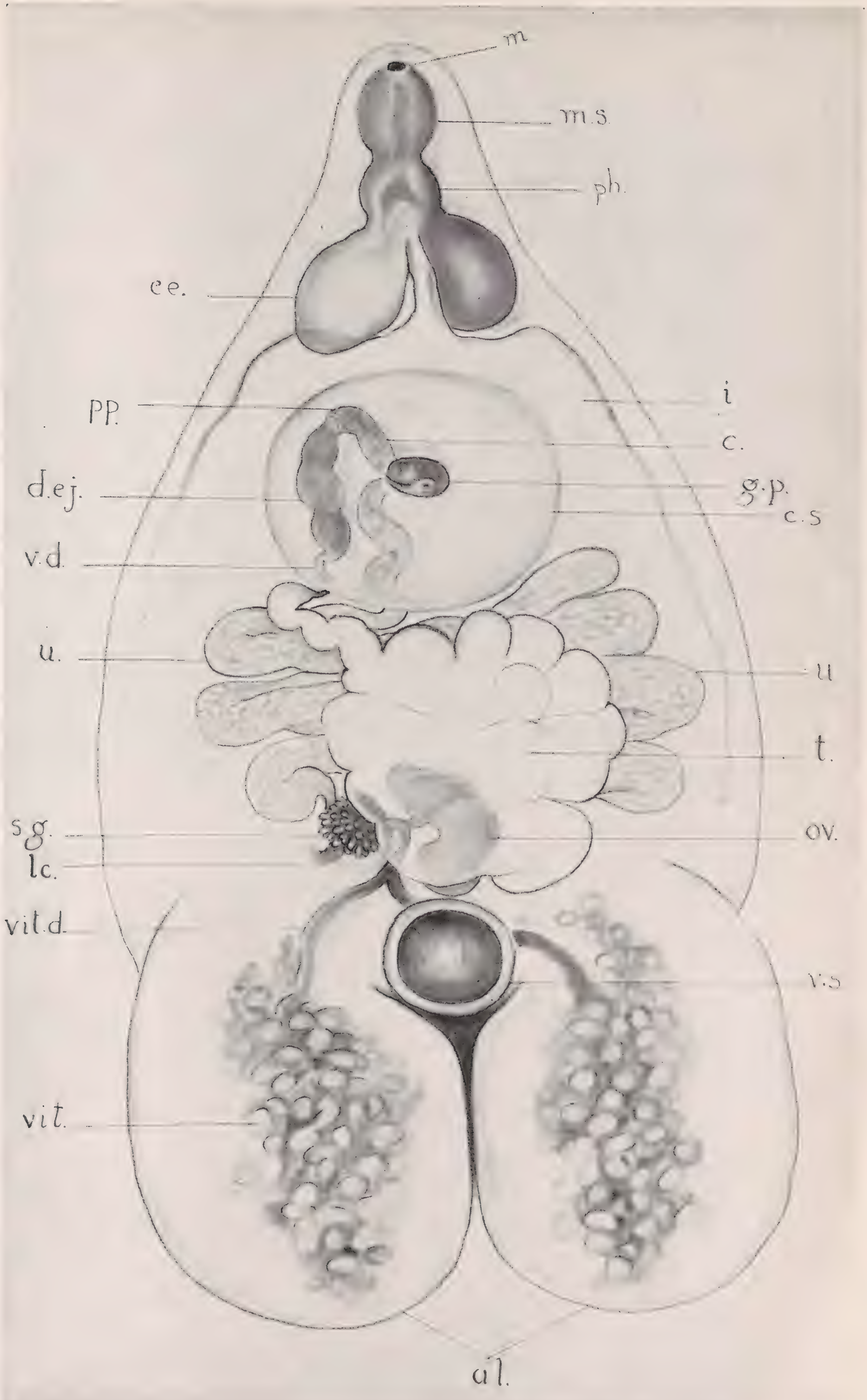


3

Cladorchis gigas sp. nov. Fig. 1. Side view. $\frac{3}{1}$. Fig. 2. Ventral view. $\frac{3}{1}$. Fig. 3. Section through the cirrus sac, showing details of reproductory organs. $\frac{25}{1}$.



Cladorchis gigas sp. nov. Sagittal section. $\frac{9}{1}$.



Cladorchis gigas sp. nov. Ventral view. Reconstruction of the internal anatomy after serial sections. $\frac{9}{1}$.

59.7,31 C (75.9)

Article XXXVII.— ICHTHYOLOGICAL NOTES FROM A CRUISE OFF SOUTHWEST FLORIDA, WITH DESCRIPTION OF *GOBIESOX YUMA* SP. NOV.).

By John Treadwell Nichols.

Plate CXI.

On March 31, 1917, the writer as the guest of Mr. Herman Armour Nichols of Chicago, joined the Auxiliary Ketch Yacht 'Yuma,' at Long Key, Florida, for a three weeks cruise, hoping to make observations with important bearing on the relationship and habits of Florida ground sharks (*Carcharhinus*). Other notes of interest from the cruise are included with such shark observations in the present paper. The 'Yuma' proceeded from Long Key to the vicinity of Sandy Key, off Cape Sable, thence past Cape Sable to spend the night of April 3 at the mouth of Lostmans River on the West coast, of April 4 at Rabbit Key, of April 5 and 6 at Marco, April 7, 8, and 9 inside a pass about 12 miles south of Sanibel Light, and April 10 up close to the light. Thence returning down the coast, Sandy Key was again reached on April 13 and three days were spent among the Keys immediately south and southeast of Cape Sable. Returning via Long Key, we anchored near the trestle at Lower Metacumbe Island for the nights of April 16 and 17, and after spending one night at Jewfish Bank nearby, proceeded to Miami, where we left the 'Yuma' on April 20.

Carcharhinus commersonii *Blainv.*

Plate CXI, Figs. 1, 3 and 4.

Carcharhinus obscurus Thorne & Nichols, Copeia No. 35, Sept., 1916.

Small individuals of this shark were seen in the Bay of Florida near Man-o-war-hawk Bush, April 2, and one of them, a young bull 5 ft. 8 in. in total length, taken. A sting or whip-ray spine was imbedded in the muscle at the corner of its mouth. A steak cut from its side and fried was excellent eating, not at all tough and suggesting swordfish in flavor.

It agreed well in all respects, including its dark color and brown eye with a large bull shark taken in Great South Bay, New York, August 3, 1916 (Copeia, No. 35, p. 73). If we refer such Long Island individuals to *commersonii*, I have never seen *C. obscurus* from northern waters. Two small individuals, 24 to 26 in. long received several years ago by this Museum from the U. S. Bureau of Fisheries laboratory at Woods Hole, Mass., as *obscurus,* are *C. milberti.* The original descriptions of *obscurus* and *milberti* are unsatisfactory. As the type of *milberti* was from New York, it was pretty surely the member of the genus which greatly predominates there and for which we use the name.

Le Sueur's type figure of *obscurus* agrees with a newly born fish 25 in. long taken in southern Florida about February, 1910.

C. commersonii is common in Florida. We have excellent photographs of a female 8½ ft. long, taken at Key West, January 13, 1910, by the Fabbri Tecla Expedition, which contained 6 young, 17 to 18 in. long, three of which are preserved in the Museum collections. This fish differed in no essential from the New York bull referred to above, save color which was much paler, very likely due to the white shell-sand bottom off Key West. The Museum collections contain also the following *commersonii* taken at Key West by the same expedition: A young one 36 in. long, and an unborn young 21 in. long taken February 20.

Compared with other U. S. Atlantic *Carcharhinus,* this shark has upper teeth broad, not strongly notched, snout broad and rounded, dorsal low, no ridge on back behind it, second dorsal origin before anal, anal and caudal lobes prominent, eye sometimes or always brown.

Garman is right in using the name *commersonii* for this species rather than *lamia,* though I can not agree with him in considering as synonyms of *commersonii* all the species which he does. The 29 in. (27 in its present shrunken condition) *Carcharhinus* taken in summer at Para, Brazil, referred to *C. platyodon* by Starks,[1] I would place with *commersonii* to which it is at least very close.

Supposing, as is most likely, that the young of *commersonii* are larger at birth than those of *limbatus; commersonii, limbatus,* and *acronotus,* probably all give birth to their young on the Florida coast at about the same date in the spring, and the 36 in. *commersonii* from Key West may reasonably be supposed to be a yearling shark.

Carcharhinus limbatus (*Müller & Henle*).

The following specimens of this species were taken:

Place	Date	Sex	Total length	No. of young	Length of young
Rabbit Key, West Coast	April 4	♀	5 ft. 5 in.	3♂ 3♀	21 to 22 in.
Marco	April 5	♀	5 ft. 3 in.	0♂ 6♀	23 in.
S. of Sanibel Light	April 7	♀	5 ft. 3 in.	2♂ 2♀	22 in.
Off Sandy Key	April 13	♀	5 ft. 2 in.	3♂ 0♀	about as usual.
Off Sandy Key	April 16	♀	4 ft. 11 in.	None	

---

[1] Stanford Univ. Pub. No. 11, 1913, p. 4.

The jaws of the Rabbit Key shark were saved, and the tips of two sting or whip ray spines found embedded about the mouth. A steak cut from the side of this same one fried was good, resembling that from the *C. obscurus*, though somewhat less excellent.

The close conformity in the size of the young indicates a very definite breeding date.

It is significant that no males of this species or of *C. acronotus*, which also had young, were met with. It appears that when with young, female ground sharks (*Carcharhinus*) are not accompanied by males of the same species. Considerable data proves this for *C. milberti* of Great South Bay, N. Y.

C. limbatus was the shark most commonly met with. It is an active species, frequently taken when trolling for tarpon, and known to the boatmen as mackerel shark. The much rarer Lamnidæ with better right to the name would very likely be called the same if taken. A 40 in. *limbatus* taken in southern Florida by the Fabbri Tecla Expedition, about Feb. 1910, was very likely two years old.

Carcharhinus acronotus (*Poey*).

Plate CXI, Fig. 2.

Two females of this shark were taken, respectively, in the mouth of Shark River on April 12 and on Jewfish Bank, April 18. Each was 3 ft. 9 in. in total length and contained four young, two males and two females, 17½ to 18 in. long. The former was yellowish grey, paler below, iris pale yellowish. It had a sting or whip ray spine embedded about the jaws. The latter was pale greenish yellowish, including its iris, below paler. A steak cut from its side and fried was fairly good.

According to Capt. J. S. Thompson, this species is abundant and known as "mackerel shark" as well as *C. limbatus*.

Beside the above three species of the genus *Carcharhinus*, a young male hammerhead *Sphyrna zygæna* 6 ft. long was taken at Rabbit Key, April 4 and a female yellow shark (*Hypoprion brevirostris*), 6 ft. 10 in. long, among the Keys in the Bay of Florida southeast of Cape Sable on April 15. It contained no young, and no sting or whip ray spines about the jaws. A steak cut from its side and fried was good.

Pristis pectinatus *Latham.*

On April 3, a young one about 2 ft. in total length, was observed swimming in a few inches of water along the shore of Sandy Key. On April 13, a female sawfish of perhaps 15 ft. in length, was taken containing young only 13 in. long with large yolk-sac attached. The two foot fish was presumably one year older than these smaller ones. In the Museum collections are a male of 30 and a female of 26 inches taken in Southern Florida in the early spring of 1910 by the Tecla Expedition, and a female of 29 in., taken by E. C. Starks at Natal, Brazil, in the summer of 1911. My hypothesis is that the young are born in September about 18 in. long throughout the range of the species, and the gestation period lasts one year.

Gobiesox yuma sp. nov.

The type and only specimen obtained, No. 5737, American Museum of Natural History, taken in a bay about 12 miles south of Sanibel Light, Florida west coast, April 10, 1917, coming aboard with the anchor. There was about 10 ft. of water at

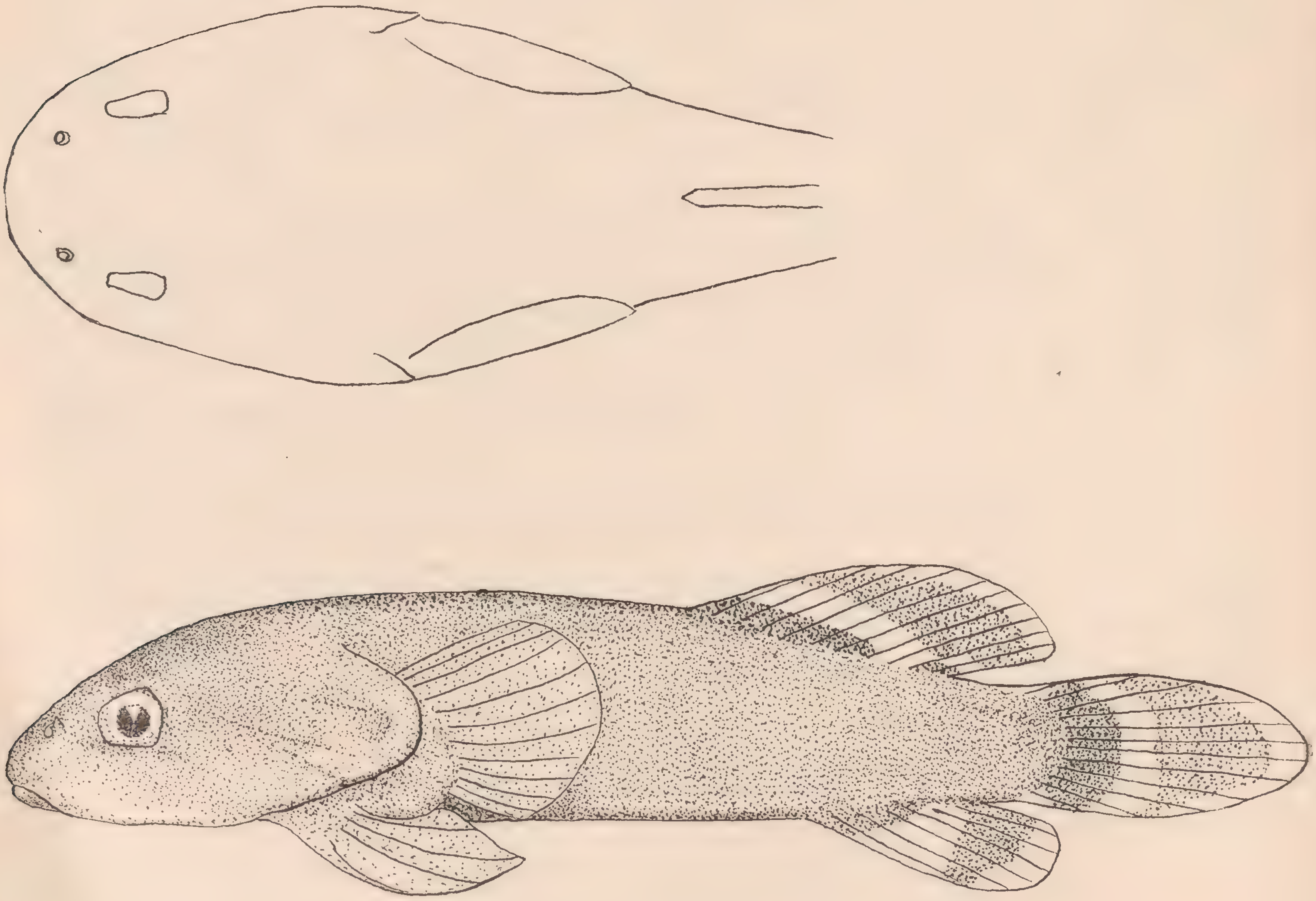
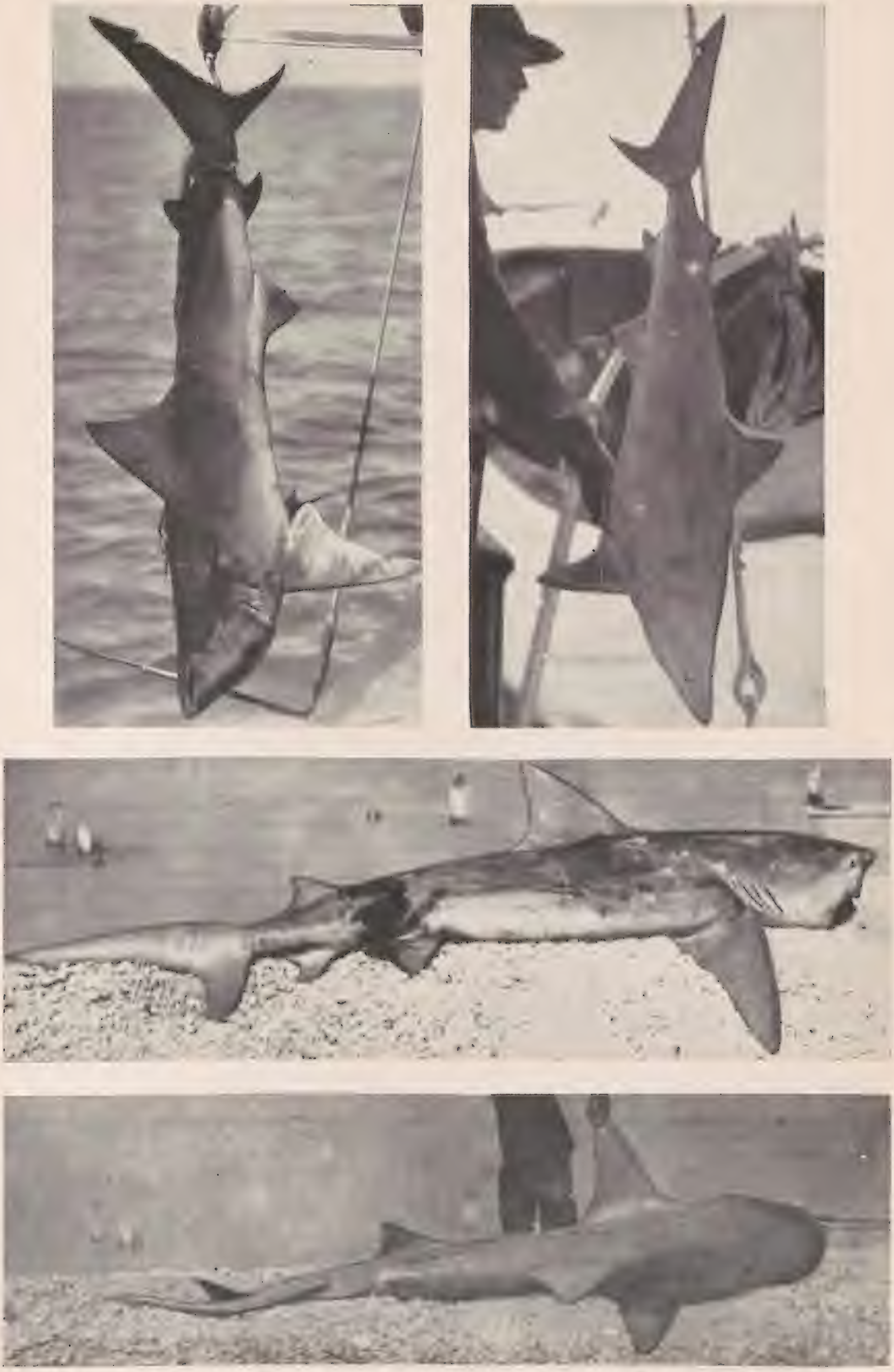


Fig 1. *Gobiesox yuma* sp. nov.

this point at low tide. It is 29 mm. in total length; head 2.8 in length to base of caudal (3.25 in total length); depth 4.5 (5.25 in total); breadth of head 1.25 in its length; interorbital 2.5; eye 2.5 in interorbital. Breadth of mouth 2 in head; length of disk 1.3. Mouth slightly inferior; a well developed opercular spine; lateral teeth of lower jaw conical slightly curved, the central teeth broad, compressed incisiform, not evenly truncated but scalloped so as to be very slightly tricuspid; dorsal origin from caudal base 1.8 in its distance from snout. Dorsal 11. Anal 7. Pectoral 2.1 in head. Caudal rounded, subacuminate, 1.75 in head. Color dark slaty, uniform; under side of head whitish; caudal black edged with white, and with a white band across its base. Dorsal dusky edged with white, with a black basal and white sub-basal stripe, except at the 8th and 9th rays where it is merely pale at the base. Anal marked with dusky and white.

I have been unable to place this fish with any described species. It is too deep and chunky for *G. virgatulus*. It was difficult to pick up from the wet deck where it clung, wriggling. If the not evenly truncate teeth should place it in *Arbaciosa,* that genus is scarcely worth recognition. Named for the ketch 'Yuma' to whose anchor it clung and from which it was taken.



FLORIDA GROUND SHARKS.

1. *Carcharhinus commersonii* ♂. Length 68 in.
2. *Carcharhinus acronotus* ♀. Length 45 in.
3 & 4. *Carcharhinus commersonii* ♀. Length 102 in.

INDEX TO VOLUME XXXVII.

New names of genera, subgenera, species, and subspecies are printed in **heavy-faced** type, also the main reference in a series of references.

Abbottana clemataria, 102.
Abræus dufaui, 203.
Acalles longulus, 217.
Acanthocleithron, 654, **720,** 749.
  chapini, 655, 656, **721.**
Acanthopterygii, 738.
Achatodes zeæ, 61.
Acherdoa ferraria, 63.
Achlarus lycidas, 27.
Achryson surinamum var. pallens, 209.
Acidalioides eoides, 69.
Acmæodera contigua, 205.
  cruenta, 205.
Acolastus amyntas, 26.
Acolobicus lineaticollis, 201.
Acoloithus falsarius, 107.
  rectarius, 107.
Acris gryllus, 621.
Acritus analis, 202.
  atomulus, 202.
Acrobasis comptoniella, 129.
  evanescentella, 129.
  tenuella, 129.
Acrolophus cervinus, 147.
  hulstellus, 147.
  plumifrontellus, 147.
Acronycta persuasa, 53.
  xyliniformis, 54.
Acylomus cubiensis, 199.
  detractus, 199.
  quadrispinosus, 199.
Adejeania brasiliensis, 229.
Adelocera subcosta, 204.
Aderocharis conifer, 199.
  obscurior, 199.
Adetus lherminieri, 210.
Adimerus dubius, 201.
Æaphes decoloratus, 205.
Ægintha, 261.
Ægithus clavicornis, 200.
Æolus elegans, 205.
Æthria rubipectus, 339.
Africa, botanical regions of, 744.
African fishes, distribution of, 746–752.
Afrida ydatodes, 47.
Agathodes monstralis, 114.
Agkistrodon contortrix, 632.
Agnomonia anilis, 75.
Agraulis vanillæ, 13.
Agriochœrus, 573, 574.
Agrotis dapsilis, 57.
  ypsilon, 57.
Ahasverus advena, 201.
Aidemosyne, 261.
Alabama argillacea, 65.
Alamosa bipunctella, 134.
Alarodia slossoniæ, 106.
Alcis luridula, 96.
Alcothoe caudata, 108.
Alestes, 679, 747.
  bimaculatus, 657, **680.**
  carmesinus, 654, 662, **681.**
  grandisquamis, 656, 658, 660, 662, **681.**
  imberi, 658, 660, 661, **680.**
  liebrechtsii, 656, 657, 660, 661, **679.**
  longipinnis, 660, **680.**
  macrolepidotus, 657, 658, 660, 661, **680.**
  macrophthalmus, 657, 659, 661, **679.**
  nurse, 658, **680.**
  schoutedeni, 658, 660, **680.**
Allabenchelys, 748.
Allecula flavipes, 214.
Allen, J. A., skeletal characters of *Scutisorex* 769–784.
Allen, J. A., Lang, Herbert, and Chapin,

James P., the American Museum Expedition collection of bats, 405–563.
Allomops, 470.
Alloperdita, 241.
Allothrombium **pulvinus,** 157.
Allotria elonympha, 74.
Alloxacis dorsalis, 215.
Almodes terraria, 86.
Alphitobius diaperinus, 214.
piceus, 214.
Alypia octomaculata, 52.
wittfeldi, 52.
Amadina, 261, 262, 263, 276.
erythrocephala, 276.
fasciata, 276.
Amarginops, 654, **713,** 749.
platus, 655, 662, **713.**
Amauresthes, 261, 262, 274.
fringilloides, 274.
Ambia striatalis, 121.
Amblygnathus vitraci, 195.
Amblyospiza, 261, 262, 263, 267.
capitalba saturata, 267.
Amblyrhiza, 185.
Amblyrhizinæ, 186.
Amblyscirtes meridionalis, 33.
vialis, 33.
Ametris nitocris, 86.
Ammalo eglensis, 48.
eglensis var. inopinatus, 48.
insulata, 48.
tenera, 48.
Amobiopsis **ornata,** 221.
Amolita fessa, 66.
roseola, 66.
sentalis, 66.
Ampeloeca myron cnotus, 42.
versicolor, 42.
Amphibius, 749.
Amphichiromys, 833.
Amphilius **notatus,** 655, 658, **715.**
Amphion nessus, 42.
Amyna octo, 65.
orbica, 65.
Anabantidæ, 738, 751.
Anabas, 752.
congicus, 662, **732.**
nanus, 656, 657, 658, 659, 662, **732.**
nigropannosus, 657, 659, 662, **732.**
Anacampsis argyrothamniella, 143.
laguncalariella, 143.
Anæa portia, 18.
Analcis fulvicornis, 217.
Ananca vittata, 215.
Anania florella, 112.
Anaphora morrisoni, 147.
propinqua, 147.
tenuis, 147.
Anaplectes, 261, 262, 263, **271.**
melanotis, 271.
rubriceps, 271.
Anartia jatrophæ, 16.
Anatrytone arogos, 35.
logan, 35.
vitellius, 35.
Ancharius, 749.
Anchastus rufescens, 205.
Anchiceratops, 281.
Anchonus suillus, 216.
Ancodon, 573, 574.
Ancyloxypha numitor, 30.
Andersonia, 750.
Andrena (Andrena) **æquatorialis,** 235.
(Andrena) **boswendica,** 236.
Anepischetos bipartita, 67.
Angel Peak region, geology of, 821, 822.
Ania lombaria, 101.
Anisolabis annulipes, 638.
ambigua, **638.**
janeirensis, 638.
maritima, 635, **638.**
minuta, **639.**
Anisonchus sectorius, 822.
Anisota consularis, 44.
stigma, 44.
Anomala undulata, 208.
Anomalospiza, 261, 262.
Anomis serrata, 66.
Anorthodes tarda, 54.
Anosia berenice, 20.
plexippus, 20.
Ansorgia, 749.
vittata, 660, 710.
Anthanassa frisia, 14.
texana, 14.
texana var. seminole, 15.
Anthonomus elegans, 217.
julichi, 217.

Anthonomus varipes, 217.
Anthony, H. E., new fossil rodents from Porto Rico, with additional notes on *Elasmodontomys obliquus* and *Heteropsomys insulans*, 183–189; a new rabbit and a new bat from Neotropical Regions, 335–337; two new fossil bats from Porto Rico, 565–568.
Antiblemma inexacta, 77.
  inexacta var. minorata, 77.
Anticarsia ferruginea, 77.
  gemmatilis, 76.
Antimachus, 214.
  roudeni, 214.
Antispila eugeniella, 144.
Apæcasia deductaria, 95.
  extremaria, 95.
Apantesis arge, 50.
  michabo, 50.
  nais, 51.
  phyllira, 50.
  placentia var. flammea, 51.
  vittata, 50.
  vittata var. phalerata, 51.
  vittata var. radians, 50.
Apate francisca, 207.
  terebrans, 207.
Apatela afflicta, 53.
  brumosa, 53.
  chionochroa, 53.
  clarescens, 53.
  furcifera, 53.
  hamamelis, 53.
  impressa, 53.
  lætifica, 53.
  lithospila, 53.
  lobeliæ, 53.
  longa, 54.
  oblinita, 54.
  tritona, 53.
Apatelodes angelica, 82.
  angelica var. indistincta, 82.
  torrefacta, 82.
  torrefacta var. floridana, 82.
Apatemys, 833, 837.
Apatosaurus, 357.
  minimus, 358.
Apatura misippus, 14.
Apenes morio, 195.
Apenes opaca, 195.
  parallela, 195.
  variegata, 195.
Aphanolemur gibbosus, 854.
Aphelops, 576.
Aphodius granarius, 208.
  granarius var. undescribed, 208.
Aphrissa statira, 10.
Aphthona compressa, 211.
  maculipennis, 212.
Apion portoricanum, 218.
Apolema carata, 95.
Apostraphia charithonia, 20.
Aproærema crotalariella, 121, 143.
Aræcerus fasciculatus, 220.
Archæopteryx, 307.
Archips argyrospila, 139.
  georgiana, 139.
  obsoletana, 139.
  rosaceana, 139.
Ardops, 336.
  haitiensis, 336.
Aresia parva, 47.
Argynnis cybele, 14.
Argyria argentana, 126.
  auratella, 126.
  differentialis, 126.
  lacteella, 126.
  multilineatella, 126.
  nivalis, 126.
Aristotelia ivæ, 142.
Arius, 749.
  africanus, 655, 662, **716.**
Arsilonche henrici, 54.
Arta statalis, 123.
Artace punctistriga, 86.
Asciodes anormalis, 114.
  gordialis, 113.
Aspidoglossa vulnerata, 195.
Aspidomorpha bajula, 212.
Asprotilapia, 750.
Atactopsis, 229.
  facialis, 229.
Atænius figurator, 208.
  gracilis, 208.
  imbricatus, 208.
  rhyticephalus, 208.
  stercorator, 208.
  terminalis, 208.

Atalopedes campestris, 30.
Atethmis subusta, 61.
Athena eleucha, 17.
    peleus, 17.
Athetis prima, 54.
Atholus confinis, 203.
Athyreus tridentatus var. castaneus, 208.
Atlides halesus, 22.
Atomus **longilinea,** 155.
    niger, 154.
Atopochilus, 749.
Atractocerus, 206.
    brasiliensis, 206.
Atreus plebeja, 38.
Attelabus bipustulosus, 217.
    foveipennis, 217.
    mutabilis, 217.
Atteva aurea, 140.
    gemmata, 141.
Auchenoglanis, 749.
    ballayi, 656, 657, 658, 659, 660, 662, **716.**
    occidentalis, 656, 657, 658, 662, **715.**
Aulonium bidentatum, 201.
Autographa abrota, 64.
    basigera, 64.
    biloba, 64.
    brassicæ, 64.
    egena, 64.
    ou, 64.
    oxygramma, 64.
    rogationis, 64.
    verruca, 64.
Automeris io lilith, 44.
Azelina atrocolorata, 101.
    rectissima, 101.
zalissaria, 101.

Bactra lanceolana, 137.
    verutana, 137.
Bagrus, 749.
    ubangensis, 662, 656, 658, 662, **710.**
Bandera carneela, 134.
Barbus, 748.
    atromaculatus, 655, 657, 658, 661, 662, **697.**
    candens, 655, 661, **701.**
    caudovittatus, 656, 658, **697.**
Barbus, **dolichosoma,** 655, 656, **700.**
    fasolt, 659, 661, **696.**
    holotænia, 656, 657, 658, 659, 661, **697.**
    musumbi, 655, 660, **697.**
    pleuropholis, 655, 656, 659, 661, 662, **698.**
    rubripinnis, 655, 660, **699.**
Barilius, 748.
    kingsleyæ, 658, **703.**
    lujæ, 661, **702.**
    salmolucius, 655, 656, 659, 660, 661, **702.**
    ubangensis, 656, 659, **702.**
    weynsii, 656, 660, 661, **702.**
Baris tabaci, 218.
Barornis regens, 307.
Basilarchia archippus, 17.
    astyanax, 17.
    floridensis, 17.
Basilodes pepita, 63.
Basilona imperialis, 45.
Bathilda, 261.
Bathybates, 751.
Batocera rubus, 210.
Batonota rugosa, 212.
Bayonia, 751.
Bdella peregrina var. **iowaensis,** 150.
    tenuirostris, 149.
Bedellia minor, 145.
Bellura gortynoides, 60.
    melanopyga, 60.
Belonoglanis, 750.
    tenuis, 658, 659, 662, **723.**
Belonuchus gagates, 199.
Belophorus maculatus, 218.
    militaris, 218.
Bembidium fastidiosum, 194.
Benta floridella, 128.
    malanogrammos, 128.
    malanogrammos var. diluculella, 128.
    speciosella, 128.
Berginus, 202.
    bahamicus, 202.
Blastobasis eriobotryæ, 144.
    guilandinæ, 144.
Blepharomastix ebulealis, 113.
    magnalis, 113.

Blepharomastix ranalis, 113.
  stenialis, 113.
Bleptina caradrinalis, 80.
  inferior, 80.
  inferior var. medialis, 80.
Bomolocha baltimoralis, 81.
  bijugalis, 81.
  citata, 81.
  manalis, 81.
  umbralis, 81.
Borolia ligata, 60.
Botanebius, 217.
Botrodus, 201.
Brachinus gilvipes, 195.
Brachyceratops, 281.
Brachycope, 261, 262, 271.
  anomala, 245, 271.
Brachypeplus mutilatus, 203.
Brachysphænus marginatus, 200.
Brachyspiza capensis, 587.
  capensis antillarum, 333.
Brenthus anchorago, 218.
  turbatus, 218.
Brephidium isophthalma, 25.
Brown, Barnum, a complete skeleton of the horned dinosaur *Monoclonius*, and description of a second skeleton showing skin impressions, 281–306.
Bruchus amicus, 213.
  chinensis, 213.
  obtectus, 213.
  rufimanus, 213.
  sallei, 213.
Bruchus sinuatus, 213.
  tetricus, 213.
Bryconæthiops, 747.
  microstoma, 656, 657, 659, 660, 661, 662, **678.**
  yseuxii, 655, 678, **679.**
Bucculatrix ivella, 145.
Bufo americanus, 621.
  fowleri, 622.
Buprestis decora, 205.
  lineata, 205.

Caberodes confusaria, 102.
  juncturaria, 102.
Cænopus, 576.
Cænurgia convalescens, 72.
Calamichthys, 746.
Calandra linearis, 218.
  oryzæ, 218.
Calaspidea grossa, 212.
Calasymbolus excæcatus, 39.
Calephelis cænius, 22.
  virginiensis, 22.
  virginiensis virginiensis, 21.
Calera, 134.
  albicostella, 134.
Calidota strigosa, 51.
Callichroma elegans, 209.
Callicista columella, 24.
Callicore clymena, 17.
Callidryas eubule, 9.
  eubule var. sennæ, 10.
Callignathus, 364.
Callomegas, 209.
Callopistria floridensis, 71.
Calosoma alternans, 195.
  calidum, 195.
Calpodes ethlius, 33.
Calycopis cecrops, 24.
Calymmaderus bibliothecarum, 206.
Campometra amella, 77.
  cinctipalpis, 77.
  mima, 77.
Camptogramma stellata, 93.
Canidia scissa, 62.
Cantharis, 216.
Canthidium melanocephalum, 207.
Capnodes punctivena, 77.
  rufinans, 78.
Capua lentiginosana, 139.
Caradrina spilomela, 54.
Carama cretata, 106.
Carcharinus acronotus, 875.
  commersonii, 873.
  limbatus, 874.
  milberti, 874.
  obscurus, 873.
Carcinops troglodytes, 202.
Caripeta angustiorata, 95.
  angustiorata var. latiorata, 95.
  aretaria, 95.
Carphophis amœnus, 631.
Carpophilus (Colopterus) amputatus, 203.
  (Colopterus) truncatus, 203.

- Carpophilus dimidiatus, 203.
  - dimidiatus var. mutilatus, 203.
  - hemipterus, 203.
- Caryoborus nucleorum, 213.
- Casandria inflexa, 57.
  - nigroguttata, 57.
- Casinycteris argynnis, 408, 412, 421, **511.**
- Casnonia insignis, 195.
- Catia drury, 31.
  - drury var. egeremet, 32.
- Catocala alabamæ, 74.
  - amasia, 74.
  - amatrix, 73.
  - amica, 74.
  - amica var. androphila, 74.
  - amica var. suffusa, 74.
  - cara, 73.
  - clintoni, 74.
  - coccinata, 73.
  - coccinata var. sinuosa, 73.
  - cratægi, 74.
  - epione, 73.
  - ilia, 73.
  - jair, 74.
  - micronympha, 74.
  - micronympha var. gisela, 74.
  - micronympha var. hero, 74.
  - micronympha var. ouwah, 74.
  - muliercula, 73.
  - sappho, 73.
  - similis, 74.
  - ultronia, 73.
  - ultronia var. celia, 73.
  - vidua, 73.
- Catopyrrha coloraria, 95.
  - coloraria var. dissimilaria, 95.
  - sphæromacharia, 95.
  - sphæromacharia var. perolivata, 95.
- Cautethia grotei, 40.
- Celama obliquata, 47.
  - sorghiella, 47.
- Celerio lineata, 43.
- Celina grossula, 196.
- Centropus burchelli, 249.
  - monachus, 249.
  - neumanni, 249.
- Cerathyla, 797, 801–812.
  - bubalus, 797, 808.
  - **johnsoni,** 798–803.
- Cerathyla panamensis, 809.
- Ceratocis, 207.
- Ceratomia catalpæ, 38.
  - undulosa, 38.
- Ceratops, 281.
- Cercyon nigriceps, 197.
  - quisquilius, 197.
  - variegatum, 197.
- Cercyonis alope, 18.
  - pegala, 18.
- Cerotoma ruficornis, 211.
  - trifurcata, 211.
- Cerura scitiscripta, 84.
- Chabuata lutina, 59.
- Chærephon (Lophomops) **abæ,** 410, 411, 412, 414, **464–466,** 487, **553.**
  - (Lophomops) **chapini,** 410, 412, 414, 460, **461–463,** 487, **551.**
  - (Lophomops) **cristatus,** 410, 411, 414, **463–487, 552.**
  - **frater,** 410, 412, **456–458, 546.**
  - **russatus,** 410, 412, 414, **458–460,** 487, **547–551.**
  - sp. indet., 410, 411, **460, 551.**
- Chæridium insulare, 207.
- Chætocnema apricaria, 212.
- Chalcodermus pupillatus, 217.
- Chalcoela iphitalis, 127.
- Chalcolepidius obscurus, 204.
  - validus, 204.
- Chalcophana, 210.
  - furvida, 210.
- Chalepus sanguinicollis, 212.
- Chalinitis olealis, 123.
- Champsochromis, 751.
- Chamyris cerintha, 69.
- Channallabes, 748.
  - apus, 659, 660, 661, 662, **707.**
- Chapin, James P., the classification of the Weaver-Birds, 243–280; see also Allen, J. A.
- Chapman, Frank M., descriptions of new birds from Santo Domingo and remarks on others in the Brewster-Sandford Collection, 327–334.
- Characinidæ, 736, 747.
- Charadra deridens, 52.
  - illudens, 53.
  - sudena, 53.

Chelæthiops, 748.
  elongatus, 656, 661, **704.**
Chelonarium punctatum, 204.
Chelydra serpentina, 624.
Chelymorpha angusticollis, 212.
  argus, 212.
  flavicollis, 212.
  multipunctata, 212.
  polysticha, 212.
  swartzii, 212.
Cherostus, 213.
  jamaicensis, 213.
Chilo densellus, 127.
  squamulellus, 127.
Chilocampyla dyariella, 145.
Chilochromis, 751.
Chilocorus cacti, 200.
Chiloglanis, 749.
  batesii, 658, **720.**
Chilotilapia, 751.
Chipota perlepidella, 135.
Chiromantis rufescens, 811.
Chiromyoides, 833.
Chlorida festiva, 209.
Chloridea virescens, 61.
Chlorippe alicia, 18.
  celtis, 18.
  clyton, 18.
  flora, 18.
Chlorissa pistaceata, 88.
  subcroceata, 88.
Chlorochlamys chloroleucaria, 88.
Chloropeta, 249.
Chloropteryx tepperaria, 88.
Choreutis carduiella, 141.
  carduiella var. busckiella, 141.
Chriacus, 828.
Chrysichthys, 749.
  acutirostris, 655, 657, **710.**
  brevibarbis, 662, **710.**
  cranchi, 657, 662, **711.**
  delhezi, 656, 658, 660, 662, **711.**
  duttoni, 662, **711.**
  furcatus, 657, **710.**
  longibarbis, 662, **711.**
  ornatus, 659, 660, 662, **711.**
  punctatus, 656, 662, **711.**
  thomeri, 660, 662, **711.**
  wagenaari, 656, 660, **711.**
Chrysobothris denticulata, 205.
  lepida, 205.
  tranquebarica, 205.
Cichlidæ, 738, 750.
Cicindela argentata var. pallipes, 194.
  boops, 194.
  cardini, 194.
  cubaba, 194.
  marginata, 194.
  olivacea, 194.
  suturalis, 194.
  suturalis var guadeloupensis, 194.
  suturalis var. hebræa, 194.
  trifasciata, 194.
  viridicollis, 194.
Cicinnus melsheimeri, 104.
Cilea pulchellus, 199.
Cindaphia bicoloralis, 117.
Cinglis albidula, 89.
  compensata, 89.
Cinnamopteryx, 263.
Cipex schwarzi, 636.
Cirphis calpota, 60.
  subpunctata, 59.
Cissia eurytus, 19.
  sosybius, 19.
Citharidium, 748.
Citharinus, 748, 759.
  congicus, 658, 661, **689.**
  gibbosus, 656, 658, 661, **689.**
Citheronia regalis, 44.
  sepulchralis, 45.
Cladis nitidula, 200.
Cladorchis, 866.
  gigas, 867–870.
  helostomatis, 866.
  pangasii, 866.
Clæotus rufopiceus, 208.
Clariallabes, 748.
Clarias, 748.
  angolensis, 656, 658, 659, 661, **707.**
  breviceps, 655, 661, **706.**
  bythipogon, 656, 658, 659, 660, 661, 662, **707.**
  lazera, 704.
  malaris, 655, 661, **705.**
  platycephalus, 659, 661, **705.**
  submarginatus, 658, **706.**
  zygouron, 655, 659, **704.**

Clarotes, 749.
Clemensia albata, 48.
Clemmys **nuchalis,** 624.
Cleora defectaria, 97.
  indicataria, 99.
  pampinaria, 99.
  pergracilis, 98.
  umbrosaria, 98.
  vellivolata, 99.
Clivina bipustulata, 195.
Clupediæ, 747.
Clytospiza, 252, 261, 263, 275.
  nonteiri, 244, 245, 275.
Cobubatha numa, 69.
  olivacea, 69.
Cocceius pylades, 27.
Coccinella 9-notata, 200.
Coccopygia, 261, 263.
Coccotrypes anonæ, 220.
  bakeri, 220.
  hubbardi, 220.
  robustus, 220.
  thrinacis, 220.
Coccyzus americanus, 249.
  erythropthalmus, 249.
Cochlidion y-inversa, 106.
  y-inversa var. parallela, 106.
Cocytius antæus medor, 37.
Cœlotaxis, 213.
Cœnocalpe parinotata, 93.
Cogia breviceps, 363.
Colænis julia, 13.
  julia var. delila, 13.
Colaspis fastidiosa, 211.
  femoralis, 211.
  lebasi, 211.
  obscura, 211.
  suffriani, 210.
Coleophora octagonella, 144.
Coleotechnistes citriella, 144.
Coleura gallarum nilosa, 408, 410, 424, 487, **516.**
Coliuspasser, 245, 256, 261, 262, 263, 273.
  concolor, 257, 273.
  macroura, 273.
Colpodes ellipticus, 195.
Coluber constrictor, 629.
Coluocera maderæ, 204.
Comacla simplex, 47.
Composia fidellissima, 82.
Conchylodes diphteralis, 112.
  platinalis, 113.
Conibius, 213.
Conoderus, 205.
Conotelus conicus, 203.
Conotrachelus coronatus, 217.
  lineola, 217.
  presbyta, 217.
Copecrypta ruficauda **devia,** 227.
Copelatus angustatus, 196.
  posticatus, 196.
Copicucullia alfarata, 60.
Copidita simplex, 215.
  tenella, 215.
Copipanolis cubilis, 57.
  stigma, 57.
Coproporus, 199.
Coptocycla bistripunctata, 21.
  guttata, 212.
  guttata var. fuliginosa, 212.
  propinqua, 212.
  subsignata, 212.
Coptodera festiva, 195.
Coptodisca condaliæ, 144.
Cordylopeza nigrinodis, 123.
Corematodus, 751.
Coriscium randiella, 146.
Correbidia bicolor, 340.
Corticaria ferruginea, 204.
Cosmophila doctorium, 66.
  erosa, 65.
  texana, 66.
  xanthindyma, 66.
Cosmopteryx attenuatella, 144.
  floridanella, 144.
  ipomϾ, 144.
  minutella, 144.
Cosmosoma auge, 339.
  myrodora, 45.
Cossonus hamiltoni, 218.
  impressus, 218.
Cossula magnifica, 108.
Cosymbia myrtaria, 89.
Crambidia pallida, 47.
  uniformis, 47.
Crambus decorellus, 125.
  extornalis, 126.
  extorralis, 125.

- Crambus hastiferellus, 125.
  - haytiellus, 125.
  - mutabilis, 125.
  - multilinellus, 125.
  - satrapellus, 125.
  - teterrellus, 125.
- Cremastobombycia verbesinella, 145.
- Cressonia juglandis, 39.
- Criocephalus cubensis, 209.
- Crocidolomia palindialis, 111.
- Crocidophora pustuliferalis, 115.
- Crocidura nyansæ kivu, 770–773, 776–779, 784.
  - turba nilotica, 784.
- Cromeria, 747.
- Cromeriidæ, 735, 747.
- Crotalus horridus, 632.
- Cryphalus mucromifer, 220.
- Cryptobatrachus, 805, 806.
  - boulengeri, 805.
- Cryptobranchus allegheniensis, 598.
- Cryptocephalus squalens, 210.
  - viridipennis, 210.
- Cryptolechia obsoletella, 143.
- Cryptorhopalum scutellare, 202.
- Cryptorhynchus batatæ, 217.
  - lapathi, 217.
  - longus, 217.
- Cryptospiza, 261, 262, 263.
- Cultroribula confinis var. **magna,** 162.
- Cunningtonia, 750.
- **Cyanopsis,** 228.
  - **costalis,** 228.
- Cyathissa percara, 54.
- Cyclocephala notata, 208.
  - tridentata, 208.
- Cycloneda sanguinea, 200.
- Cycloplasis panicifoliella, 144.
- Cyclopodia greeffi, 559.
- Cylas formicarius, 218.
- Cylindera flava, 209.
  - puberula, 209.
- Cylindromasicera prima, 232.
- Cymatophora abbreviata, 95.
  - bicolorata, 95.
  - cervinaria, 94.
  - distribuaria, 95.
  - distribuaria var. transitaria, 95.
  - floridensis, 95.
- Cymatophora latiferrugata, 94.
  - nervata, 94.
  - nicetaria, 94.
  - particolor, 94.
  - pustularia, 94.
  - solitaria, 94.
- Cynothrissa, 655, 677.
- Cyprinidæ, 736, 748.
- Cyrtocara, 751.
- Cyrtosoma lherminieri, 214.
- Cysteophora pervertipennis, 92.
- Cystineura cana, 15.

- DACODERUS dominicensis, 213.
- Dactylosternum, 197.
  - abdominale, 197.
  - advectum, 197.
  - flavicorne, 197.
  - subdepressum, 197.
- Dahana atripennis, 46.
- Damæus **brevitarsus,** 164.
  - **minutus,** 164.
- Dannemora edentella, 134.
- Dasylophia anguina, 83.
  - anguina var. puntagorda, 83.
- Datana floridana, 82.
  - integerrima, 82.
  - modesta, 82.
- Deltatherium, 822, 825.
  - fundaminis, 823, 824.
- Dendrobates braccatus, 812.
- Dendroblaptus, 209.
- Depressaria amissella, 143.
  - amyrisella, 143.
- Derallus rudis, 196.
- Derelomus albidus, 217.
- Dermaptera, West Indian, 635–651.
- Dermestes caninus, 202.
  - carnivorus, 202.
  - vulpinus, 202.
- Desmia funeralis, 111.
  - geminalis, 111.
  - tages, 111.
- Desmognathus fusca, 609.
  - monticola, 608.
  - ochrophæa carolinensis, 609.
  - quadramaculata, 607.
- **Dexosarcophaga,** 221.
  - **transita,** 221.

Diabrotica bivittata, 211.
    gramineæ, 211.
    innuba, 211.
    melanocephala, 211.
    ochreata, 211.
    pulchella, 211.
Diacrisia isabella, 50.
    virginica, 49.
Diadophis punctatus, 630.
Diallagama lutea, 67
Diaperis maculata, 214.
Diaphania hyalinata, 115.
    infimalis, 115.
    nitidalis, 114.
    niveocilia, 115.
    olealis, 114.
    quadristigmalis, 115.
    sibillalis, 115.
Diaphanomyia, 229.
    aurea, 229.
Diaprepes abbreviatus, 216.
    balloui, 216.
    comma, 216.
    famelicus barbadensis, 216.
Diasemia janassialis, 117.
    magdalena, 117.
    nigralis, 117.
    ramburialis, 117.
Diastema tigris, 64.
Diastictis argyralis, 112.
Diatræa crambidoides, 126.
    saccharalis, 126.
Diatropura, 261, 262, 273.
    progne, 273.
Diatryma, 307–324, **321.**
    ajax, 307, 322.
    gigantea, 307, 318, 322.
    regens, 322.
    steini, 310, **322.**
Diatrymæ, 321.
Diatrymidæ, 321.
Diceratherium, 576.
Dichogama amabilis, 113.
    bergii, 113.
    redtenbacheri, 113.
Dichomeris citrifoliellus, 142.
    eupatoriellus, 142.
Dichorda iridaria, 88.
    rectaria, 88.
Dichymolomia pegasalis, 127.
Dicrepidius elegans, 205.
    ignotus, 205.
Didasys belæ, 46.
Didelphis, 574.
Didymictis haydenianus, 825.
Dinemellia, 262, 263, 265.
    bœhmi, 265.
    dinemelli, 245, 265.
Dineutes longimanus, 196.
    metallicus, 196.
Dinotopterus, 749.
Diomedea epomophora, 861.
    exulans, 861–864.
    (Rhothonia) sanfordi, 861–864.
    sanfordi, 862.
Dioryctria clarioralis, 129.
Diplocœlus, 200.
Diplodocus, 815–819.
Dipthera fallax, 54.
Dircetis pygmæa, 81.
Discognathus, 748.
    dembeensis, 655, 656, **695.**
    ornatus, 655, 661, **696.**
Dissacus, 828.
Distichodus, 748.
    affinis, 656, 657, 658, 660, **686.**
    antonii, 658, 661, **687.**
    atroventralis, 661, **687.**
    dembeensis, **695.**
    fasciolatus, 656, 658, 660, 661, **687.**
    langi, 654, 658, **687.**
    lusosso, 656, 658, 660, 661, **688.**
    maculatus, 656, 658, 660, 661, **686.**
    sexfasciatus, 656, 658, 660, 661, **688.**
Ditoma carinata, 201.
Diviana eudoriella, 132.
    verecuntella, 132.
Divitiaca ochrella, 131.
    parvuella, 131.
    simulella, 131.
Dœimodus, 750.
Dolba hylæus, 38.
Dolichorrhinia **planatella,** 131.
Doru albipes, 636, **649.**
    bimaculatum, 649.
    lineare, 636, **648.**
Doryodes bistriaris, 66.
    spadaria, 67.

Doumea, 750.
  alula, 655, 656, 658, 662, **722.**
  typica, 722.
Drapetes tunicatus, 205.
Drasteria erechtea, 72.
Drepanoplectes, 261, 262.
Drosophila ampelophila, 347–353.
Dunn, Emmett R., reptile and amphibian collections from the North Carolina Mountains, with especial reference to salamanders, 593–634.
Dynamis politus, 218.
Dynastes argentata, 208.
  lagaii, 208.
  vulcan, 208.
Dyscinetus barbatus, 208.
  picipes, 208.
  trachypygus, 208.
Dysodia flagrata, 108.
  floridanus, 108.
  speculifera, 107.
Dyspteris abortivaria, 92.

Earwigs (*Dermaptera*), studies in West Indian, 635–651.
Eastman, Charles R., dentition of *Hydrocyon* and its supposed allies, 757–760.
Eburia decemmaculata, 209.
Echiaster bupthalmus, 198.
  distinctus, 198.
  impressicollis, 198.
  sharpi, 198.
  waterhousii, 198.
Ecpantheria albicornis, 340.
  deflorata, 50.
  deflorata var. denudata, 50.
Ectoconus, 573.
Ectodus, 751.
Ectropis crepuscularia, 99.
Egryrlon filaria, 78.
Eidolon helvum, 406, 407, 408, 411, 412, **414, 497.**
Elaphe obsoleta, 629.
Elaphidion glabratum, 209.
  irroratum, 209.
  manum, 209.
  signaticolle, 209.
  tomentosum, 209.
Elasmodontomyinæ, 186.
Elasmodontomys, 185.
Elasmopalpus floridellus, 130.
  lignosellus, 130.
  melanellus, 130.
  petrellus, 130.
Eleutherodactylus lineatus, 793–797.
  martinicensis, 796, 811.
  miliaris, 795.
  petropolitanus, 812.
Elophila bifascialis, 121.
  claudialis, 121.
  drumalis, 121.
  fulicalis, 121.
  slossonalis, 121.
Elwyn, Adolph, effect of humidity on pupal duration and on pupal mortality of *Drosophila ampelophila*, 347–353.
Elytrogona bulla, 212.
  quadrodecimmaculata, 212.
Emballonuridæ, 414, 486.
Emblema, 261, 262.
Emesis cæneus, 22.
Emmiltis sparsaria, 92.
Empyreuma affinis, 339, 343.
  affinis haytiensis, 339.
  anassa, 339, **343.**
  pugione, 339, 342.
Enantiopus, 751.
Enarmonia tristrigana, 138.
Enemothrombium **ovalis,** 156.
  penicillifer, 156.
Engraulicypris, 748.
  congicus, 655, 656, 660, **703.**
Ennearthron delicatulum, 207.
Ennomos subsignarius, 100.
Enodia creola, 18.
  portlandia, 18.
Eohippus, 574.
Eois australis, 92.
  balistraria, 91.
  bonifata, 90.
  davisi, 90.
  demissaria, 90.
  eburneata, 91.
  ferrugata, 90.
  hilliata, 91.
  lacteolata, 92.

Eois lævitaria, 91.
  lanceolata, 91.
  micropterata, 92.
  nimbicolor, 91.
  obfusaria, 92.
  ossularia, 91.
  parvularia, 90.
  peralbata, 91.
  refractaria, 92.
  russata, 90.
  scintillaria, 90.
  suavata, 92.
Eomoropus, 576.
Epagoge demissana, 139.
  sulphurana, 139.
Epargyreus tityrus, 27.
  zestos, 27.
Ephesia cordelia, 74.
  polygama, 74.
Ephimia, 197.
Ephymia, 197.
Epicauta, 216.
  annulicornis, 216.
Epicorsia mellinalis, 117.
Epidromia delinquens, 75.
Epierus cubensis, 203.
  waterhousei, 203.
Epiglæa apiata, 61.
  sericea, 61.
Epimecis virginiaria, 100.
  virginiaria var. dendraria, 100.
Epipaschia interruptella, 127.
  superatalis, 127.
  zelleri, 127.
Episemasia morbosa, 93.
Episimus argutanus, 138.
  augmentanus, 138.
Epistor lugubris, 40.
  ocypete, 40.
Epitrix cucumeris, 211.
  fuscata, 211.
  parvula, 211.
Epizeuxis æmula, 79.
  americalis, 79.
  gopheri, 79.
  lubricalis, 79.
  scobialis, 79.
Epomophorus anurus, 408, 411, **420, 508.**
  franqueti, 417.
Epomophorus pusillus, 421.
  wahlbergi haldemani, 408, 411, **421, 509.**
Epomops franqueti, 406.
  franqueti franqueti, 406, 408, 411, 412, 413, **417, 500.**
Eptesicus **ater,** 409, 411, 413, **443,** 487, **533.**
  faradjius, 410, 411, 413, **444,** 487, 489, 490, **534.**
  garambæ, 410, 412, 413, **445,** 487, **535.**
  minutus, 412, 413.
  minutus minutus, 410, **445,** 486, **535.**
  tenuipinnis, 409, 412, **443, 533.**
Equidæ, 574.
Equus, 575.
Ercta ornatalis, 111.
Erebus odora, 79.
Eretmodus, 751.
Erinnyis alope, 39.
  crameri, 39.
  ello, 39.
  lassauxii merianæ, 39.
  obscura, 39.
  œnotrus, 39.
Erodiscus morio, 217.
Erynnis attalus, 32.
  leonardus, 32.
  meskei, 32.
  metea, 32.
Erythræus **phalangiolus,** 153.
  quadratus, 153.
Erythrura, 261, 262.
Estigmene acræa, 50.
  congrua, 50.
Estrilda, 261, 262, 263, 278.
  astrild massaica, 278.
  astrild minor, 278.
  atricapilla, 278.
  melpoda, 278.
  nonnula, 278.
Estrildinæ, 244, 251, 261, 263, **273–280.**
Ethmia confusella, 143.
Etiella rubribasella, 131.
  schisticolor, 131.
  zinckenella, 130.
Euacidalia sericeata, 88.

Eublemma carmelita, 68.
  flammicincta, 68.
  laphyra, 68.
Euborellia ambigua, 635, **638.**
  annulipes, 635, **640.**
  minuta, 635, **639.**
Eucalyptera bipuncta, 66.
  humeralis, 66.
Eucatagma amyrisella, 146.
Eucelatoria australis aurescens, 226.
Eucereon carolina, 46.
Euchætias egle, 51.
Euchilichthys, 749.
  dybowskii, 656, 658, 660, 662, **720.**
  guentheri, 656, 658, 659, 662, **720.**
  royauxi, 658, 662, **720.**
Euchlæna amœnaria, 101.
  astylusaria, 101.
astylusaria var. tiviaria, 101.
  pectinaria, 101.
  vinulentaria, 101.
Euclea delphinii, 105.
  nanina, 105.
Eucosma circulana, 137.
  constrictana, 138.
  desertana, 138.
  floridana, 138.
  giganteana, 137.
  lineana, 138.
  minutana, 138.
  ochraceana, 137.
  perplexana, 138.
  quinquemaculana, 137.
  strenuana, 138.
  tripartitana, 138.
  vandana, 138.
Eucosmophora sideroxyloniella, 145.
Eucrostes dominicaria, 88.
Eudamus proteus, 26.
Eudule meridiana, 92.
Eueana niveociliaria, 88.
Euerythra phasma, 49.
Eugnathichthys, 747.
  eetveldii, 656, 658, 660, 661, **683.**
  macroterolepis, 656, 658, 659, 660, 661, **684.**
Euherrichia granitosa, 71.
  mollissima, 71.
Eulia amatana, 140.
Eulia mariana, 140.
Euloewiopsis, 222.
  setosa, 222.
Eumæus atala, 22.
Eumestleta cinnamomea, 68.
  minima, 68.
  obliqualis, 68.
Eumolpus imperialis, 210.
Eunectes occidentalis, 196.
Eunica monima, 17.
  tatila, 17.
Eunomia columbina, 339.
Eunystalea indiana, 83.
Eupalus **parvus,** 151.
Euphorticus pubescens var. æneolus, 195.
Euphyes metacomet, 34.
Euphysetes, 364.
  grayii, 362.
  macleayii, 363.
  pottsii, 363.
Eupithecia miserulata, 92.
  nebulosa, 92.
Euplectes, 261, 262.
Eupseudosoma involuta florida, 48.
Eupsyche hugon, 23.
  m-album, 23.
  martialis, 23.
  telea, 23.
Euptoieta claudia, 13.
Eurema delia, 12.
  euterpe, 11.
  euterpe var. alba, 12.
  gnatheme, 12.
  jucunda, 12.
  nicippe, 11.
Eurhinus festivus, 218.
Eurymus eurytheme, 10.
  philodice, 11.
Euryscelis suturalis, 209.
Euscepes porcellus, 217.
Euscopoliopteryx, 223.
  nebulosa, 224.
Eustixia popula, 119.
Eustroma diversilineata, 93.
Eustrotia apicosa, 67.
  flaviguttata, 67.
  strigulataria, 67.
Eutelia pulcherrima, 65.
  pyrastis, 65.

Euthisanotia unio, 63.
Euthyatira candida, 85.
Eutolype rolandi, 57.
Eutomus cornatus, 213.
  fulvomaculatus, 212.
  sulcatus, 213.
Eutrombidium **corticis,** 155.
Eutropius, 749.
  congensis, 657, 658, 661, **708.**
  debauwi, 656, 659, 660, **708.**
  gastratus, 655, 658, 660, 662, **708.**
  grenfelli, 656, 658, 659, 660, 662, **708.**
  liberiensis, 657, **709.**
  niloticus, 656, 658, 662, **708.**
Euvanessa antiopa, 15.
Euxestus erithacus, 200.
  piciceps, 200.
Euxoa insulsa, 58.
Euzophera semifuneralis, 131.
Everes comyntas, 25.
Evergestis dyaralis, 111.
  rimosalis, 115.
Ewing, H. E., new Acarina. Descriptions of new species and varieties from Iowa, Missouri, Illinois, Indiana, and Ohio, 149–172.
Exelis pyrolaria, 96.
Exochomus uva, 200.
Exyra semicrocea var. hubbardiana, 68.

FAGITANA littera, 61.
  obliqua, 61.
Feltia annexa, 58.
  malefida, 58.
Feniseca tarquinus, 25.
Fentonia marthesia, 84.
Forbes, Wm. T. M., notes on West Indian Syntomidæ and Arctiidæ (Lepidoptera), 339–345.
Forficelisa annulipes, 640.
  curvicauda, 640.
Forficula albipes, 649.
  americana, 637.
  bidens, 640.
  bimaculata, 649.
  dorsalis, 641.
  linearis, 648.
Forficula maritima, 638.
  unidentata, 647.
Formicilabia, 641.
  caribea, 636, **642.**
Foudia, 261, 262, 263, 271.
  madagascariensis, 271.
Fringillidæ, 262.
Fruva apicella, 70.
  fasciatella, 70.
  parvula, 70.
Furnarius rufus, 588, 589, 592.
Fustiger haytiana, 197.

GABERASA ambigualis, 80.
Galasa rubidana, 123.
Galaxias, 743, 750.
Galaxiidæ, 738, 750.
Galerita beauvoisi, 195.
Galgula partita, 67.
Galleria mellonella, 127.
Gasterosteidæ, 752.
Gasterosteus, 752.
Gastornis, 319.
  edwardsi, 320.
  klaasseni, 320.
  parisiensis, 320.
Gastrotheca, 811, 812.
Gelechia coloradensis, 143.
Genyomyrus, 746.
  donnyi, 659, 673.
Genyornis, 309, 311.
Geothlypis æquinoctialis cucullata, 589.
Gephyrochromis, 751.
Gephyroglanis, 749.
  congicus, 662, **714.**
  longipinnis, 656, 658, 662, **714.**
Geshna cannalis, 121.
Gibbium psylloides, 206.
Gigantichthys, 759.
Ginglymostoma sp., 765.
Givira anna, 108.
  basalis, 108.
  francesca, 108.
Glaphria basiflavalis, 110.
  fulminalis, 110.
  glaphyralis, 110.
  sesquistrialis, 110.
Glauconycteris **alboguttatus,** 410, 412, 414, **449,** 487, **539.**

Glauconycteris **humeralis,** 410, 411, 412, 414, **448,** 486, **539.**
  papilio, 410, 411, 413, **447,** 487, 489, 490, **538.**
Glena cognataria, 99.
  texanaria, 99.
  umatillaria, 99.
Globicornis fulvipes, 202.
Glyphidocera floridanella, 142.
Glyphonyx quadraticollis, 205.
Glyptocera consobrinella, 130.
Glyptoscelis æneipennis, 210.
  hobsoni, 210.
Gnathobagrus, 654, **711,** 749.
  depressus, 655, 657, **712.**
Gnathonemus, 746.
  curvirostris, 657, 661, **673.**
  cyprinoides, 661, **672.**
  elephas, 656, 657, 659, 661, **672.**
  greshoffi, 656, 657, 659, 661, **672.**
  ibis, 656, 657, 659, 661, **673.**
  leopoldianus, 662, **671.**
  livingstonii, 655, 662, **671.**
  mirus, 656, 657, 659, 660, 661, **672.**
  monteiri, 656, 657, 659, 660, 661, **671.**
  moori, 659, **670.**
  numenius, 661, **673.**
  petersii, 657, 659, 660, 662, **670.**
  rhynchophorus, 656, 657, 659, 660, 661, **672.**
  stanleyanus, 657, 659, 660, 661, **671.**
  tamandua, 657, 661, **672.**
Gnorimoschema terracottella, 142.
Gobiesox **yuma,** 876.
Gonodes liquida, 54.
Gonodonta nutrix, 64.
  unica, 63.
Gonodontis antidiscaria, 101.
  hypochraria var. homuraria, 101.
  obfirmaria, 101.
Gortyna u-alba, 61.
Gracilaria burserella, 145.
  sebastianella, 146.
Grammatotria, 751.
Grammodes smithii, 75.
Grammodia caicus, 40.
Granatina, 261, 263.
Granger, Walter, notes on Paleocene and Lower Eocene mammal horizons of northern New Mexico and southern Colorado, 821–830.
Granger, Walter, and Gregory, W. K., a revision of the Eocene Primates of the genus *Notharctus*, 841–859. See also Matthew, W. D.
Graphiphora culea, 60.
  oviduca, 60.
  vindemialis, 60.
Gregory, William K., see Granger, Walter.
Griscom, Ludlow, see Nichols, John Treadwell.
Grossbeck, John A., insects of Florida. IV. Lepidoptera. Edited by Frank E. Watson, 1–147.
Gyascutus carolinensis, 205.
Gymnalabes 748.
Gymnarchus, 746.
Gynandropus guadeloupensis, 194.
Gyrinophilus danielsi, 613.
Gyrinus rugifer, 196.

HADENA miseloides, 56.
  patina, 56.
  tapeta, 56.
  turbulenta, 56.
Hæmorrhagia diffinis, 41.
  thysbe, 41.
  thysbe var. cimbiciformis, 41.
  thysbe var. floridensis, 41.
  thysbe var. fuscicaudis, 41.
Halecia aureomicans, 205.
Halisidota cinctipes, 49.
  longa, 49.
  tesselaris, 49.
Haltica ignita, 211.
  subaurea, 211.
Haplochilus elegans, 658, 659, 662, **725.**
  multifasciatus, 662, **725.**
  platysternus, 655, 662, **724.**
  singa, 662, **725.**
  spilauchen, 662, **725.**
Haplochromis, 750.
  desfontainesii, 656, 662, **727.**
  moffati, 655.
  strigigena, 655, 662, **727.**
Haplotaxodon, 751.

Haptoncus luteolus, 203.
Harpaglæa venustula, 61.
Harpyia borealis, 84.
  cinerea, 84.
Harrisina americana, 107.
  australis, 107.
Harrismemna trisignata, 54.
Hebard, Morgan, see Rehn, James A. G.
Hedylepta indicata, 113.
Heilipus, 217.
  elegans, 217.
Heliocheilus albidentina, 62.
  paradoxus, 62.
Heliopetes syrichtus, 28.
Heliophana mitis, 63.
Heliophila commoides, 60.
  extincta, 60.
  juncicola, 60.
  latiuscula, 59.
  linita, 60.
  multilinea, 60.
  pallens, 59.
  pendens, 60.
  phragmitidicola, 60.
  pilipalpis, 59.
  unipuncta, 59.
  velutina, 59.
Heliospiza, 261.
  noomeæ, 259.
Heliothis armigera, 62.
Hellula undalis, 115.
Hemerocampa inornata, 85.
Hemerophila dyari, 141.
Hemeroplanes parce, 40.
Hemiacodon, 829.
Hemiargus ammon, 25.
  hanno, 25.
Hemichromis, 751.
  bimaculatus, 662, **731.**
  fasciatus, 656, 657, 659, 660, 662, **731.**
Hemileuca maia, 44.
Hemipeplus marginipennis, 201.
Hemirhipus fascicularis, 204.
Hemistichodus, 747.
Hemithlæus baldwini, 823.
Hemitilapia, 751.
Heptaxodon, 183.
  bidens, 183.
Heptaxodontinæ, 186.
Herculia sordidalis, 122.
Herse cingulata, 37.
  cingulata var. decolorata, 37.
Hesperornis, 307.
Heterachthes, 209.
  ebenus, 209.
Heterarthron gonagra, 207.
Heteraspis nana, 210.
Heterhyphantes, 263.
Heterobranchus, 748.
  longifilis, 661, 707.
Heterocampa astarte, 83.
  biundata, 83.
  guttivitta, 84.
  lineata, 83.
  obliqua, 83.
  picta, 83.
  subrotata, 83.
  umbrata, 83.
Heterochiromys, 833.
Heterodon platirhinos, 632.
Heterohyus, 833.
Heteropsomyinæ, 189.
Heteropsomys insulans, 189.
Heterotis, 746.
Hexeris enhydris, 108.
Hilarotes chalcoptera, 205.
Hipparion whitneyi, 575.
Hippodamia convergens, 200.
  13-punctata, 200.
Hipposideros **abæ**, 409, 411, **432**, 487, 489, **525.**
  caffer, 406, 487, 489.
  caffer centralis, 409, 411, 412, 413, 430, **523**, **559.**
  caffer **niapu**, 409, 413, **431**, 486, **525.**
  cyclops, 406.
  gigas **niangaræ**, 409, 413, **438**, 487, 491, **527.**
  langi, 409, 411, 412, 413, **434–438**, 486, 489, **526.**
  nanus, 409, 411, 413, **434**, 487, **525.**
Hipposyus, 843.
  formosus, 842, 849, 850.
  robustior, 842, 852, 853.
Historis odius, 18.
Histurgops, 261, 262, 263.

Holomelina aurantiaca, 49.
  aurantiaca var. brevicornis, 49.
  diminutiva, 49.
  læta, 49.
  rubicundaria, 49.
Holotrochus smithi, 198.
Homaledra heptathalama, 145.
  sabalella, 145.
Homœosoma differtella, 133.
  electellum, 133.
  stypicellum, 133.
  uncanale, 133.
Homohadena infixa, 57.
Homophæta æquinoctialis, 211.
Homophyla krugi, 212.
Homopsomys, 187.
  antillensis, 187.
Homopyralis contracta, 72.
  monodia, 72.
  tantillus, 72.
Homosassa ella, 134.
Hoplias, 757.
Horia auriculata, 216.
  maculata, 216.
Hormoschista pagenstecheri, 71.
Hulstia dulciella, 131.
Hussakof, L., fossil fishes collected by the American Museum Congo Expedition, 761–767.
Hyamia perditalis, 71.
Hyblæa puera, 72.
Hydriomena australata, 93.
  floridata, 93.
  latirupta, 93.
  neomexicana, 93.
Hydrochus pallipes, 196.
  rugosus, 196.
Hydrocyon, 747, **757–760.**
  forskallii, 758.
  goliath, 661, **678.**
  lineatus, 657, 658, 660, 661, **678,** 757.
Hydrophilus tenebrioides, 197.
Hyla, 805.
  abbreviata, 812.
  evansi, 807.
  fuhrmanni, 803–812.
  goeldii, 807.
  ohausi, 808.
  pickeringi, 620.
Hyla versicolor, 620.
Hylephila phylæus, 30.
Hylodes anomalous, 806.
  palmatus, 806.
  ramiformis, 806.
Hylonomus, 804.
Hyloscirtus, 804, 812.
  bogotensis, 805.
  boulengeri, 805.
  fuhrmanni, 805–812.
Hymenia fascialis, 111.
  perspectalis, 110.
Hypargos, 261, 262, 263, 276.
  dybowskii, 245.
  schlegeli, 245, 276.
Hyparpax perophoroides, 84.
  perophoroides var. tyria, 84.
Hypatus bachmani, 21.
Hypena ancara, 81.
Hypenodes macula, 79.
Hypenula cacuminalis, 80.
Hyperæschra georgica, 83.
Hyperaspis apicalis, 200.
  connectens, 200.
Hypermegethes, 261, 262.
Hyperopisus, 746.
Hyphantornis, 261, 262, 263, 269.
  cucullatus, 269.
  cucullatus bohndorffi, 269.
Hyphantria cunea, 50.
  cunea var. punctata, 50.
Hyphanturgus, 261, 262, 263, 270.
  aurantius, 270.
  nigricollis, 271.
  ocularius, 270.
Hypocala andremona, 74.
Hypochera, 257, 261, 262, 263.
  chalybeata, 279.
  ultramarina, 279.
Hypolampsis nigrina, 211.
Hypolophites mayombensis, 765.
Hypoprepia miniata, 48.
Hypoptus insularis, 216.
Hyporhagus æneus, 214.
  marginatus, 214.
Hypothenemus abdominalis, 219.
  amplipennis, 219.
  brunneipennis, 219.
  ceibæ, 219.

Hypothenemus eruditus, 220.
flavipes, 219.
lineatifrons, 219.
moschatæ, 219.
obscurus, 219.
parvus, 219.
pilosus, 219.
plumeriæ, 220.
sacchari, 219.
Hypsignathus monstrosus, 408, 411, 413, **418**, 482, 485, **502–508.**
Hypsoropha hormos, 72.
monilis, 72.
Hypsotropa luteicostella, 134.
Hyrachyus, 576.
Hysterosia inopiana, 140.

ICHTHYFAUNÆ, African fresh-water, 739.
Ichthyoborus, 747.
Ichthyornis, 307.
Ide lithosina, 143.
vestalis, 143.
Iesta lisetta, 126.
Ignacio region, geology of, 826–830.
Illice unifascia, 47.
striata, 48.
subjecta, 47.
Immyrla bumeliella, 130.
Inopeplus præusta, 201.
Ischiodontus oblitus, 204.
Ischyrhiza, 759.
Isichthys, 746.
Isochætes beutenmülleri, 106.
Isolomalus nanulus, 203.
Isomera sericea, 214.
valida, 214.
Isoparce cupressi, 38.

JASPIDIA nana, 54.
teratophora, 54.
Jocara incrustalis, 127.
perseella, 127.
Jodia rufago, 61.
Jonas, Anna I., Pre-Cambrian and Triassic diabase in eastern Pennsylvania, 173–181.
Julidochromis, 751.
Junonia cœnia, 16.
lavinia, 16.

KAKOPODA cincta, 78.
Kerivoula cuprosa, 406, 410, 411, 412, **452**, 487, 489, 491, **542.**
Kneria, 747.
Kneriidæ, 735, 747.
Kogia breviceps, list of specimens, 361–364; historical, 364; measurements, 364; skull as a whole, 368–383; cranial bones, 383–389; comparison of *Kogia* and *Physeter*, 399–402; literature, 402.
floweri, 363, 364.
grayi, 363, 364.
pottsii, 364.
simius, 364.

LABEO, 748.
annectens, 656, 661, **693.**
ansorgii, 655, 651, **695.**
chariensis, 655, 656, 658, 661, **694.**
coubie, 655, 661, **690.**
cyclopinnis, 654, 661, **690.**
falcipinnis, 658, 661, **692.**
forskalii, 655, 661, **693.**
greenii, 656, 658, 661, **693.**
intermedius, 655, 660, 661, **694.**
kirkii, 655, 661, **693.**
lineatus, 661, **689.**
longipinnis, 658, 660, 661, **690.**
macrostoma, 658, 660, 661, **690.**
nasus, 661, **693.**
ogunensis, 655, 656, **695.**
parvulus, 655, 656, **693.**
parvus, 655, 656, 658, 660, 661, **695.**
sorex, 655, 661, **691.**
velifer, 655, **690.**
weeksii, 656, 658, 661, **689.**
Labia brunnea, 647.
curvicauda, 636, **640.**
dorsalis, 636, **641.**
mæklini, 642.
pulchella, 647.
trinitatis, 641.
unidentata, 641.
Labidura bidens, 636, **640.**
Labochilotes, 750.
Labogestoria gibbicollis, 201.
Laccophilus americanus, 196.
proximus, 196.

Lachnophorus leucopterus, 194.
Lachnopus curvipes, 216.
  valgus, 216.
Lactica scutellaris, 211.
Læmophlœus adustus, 201.
  iteratus, 206.
  pusillus, 201.
Lætilia coccidivora, 131.
Lagoa pyxidifera, 106.
Lagochirus araneiformis, 210.
Lagonosticta, 261, 262, 263, 277.
  brunneiceps, 277.
  rara, 277.
  rendalli, 277.
  rhodopareia, 277.
Lamna appendiculata, 765, 766.
Lamprologus, 751.
  obliquus, 655, 656, 658, 662, **731**.
Lamprolophus lithella, 145.
Lampropeltis getulus, 630.
  triangulum, 630.
Lang, Herbert, field notes on *Scutisorex*, 781–783.
Lang, Herbert, and Chapin, James P., distribution and ecology of Central African Chiroptera, 479–496; field notes on African Chiroptera, 497–560.
Lapara bombycoides, 38.
  coniferarum, 38.
  halicarniæ, 38.
Lapethus, 201.
Laphygma frugiperda, 56.
  frugiperda var. obscura, 56.
Lasioderma serricorne, 206.
Latebraria amphipyroides, 79.
Lates niloticus, 658, 662, 725.
Lathropus costatus, 202.
Lavia frons, 489.
  frons affinis, 409, **427**, 487, 490, **520**.
Lebia bitæniata, 195.
  elevata, 195.
  viridis, 195.
Lema confusa, 210.
  dorsalis, 210.
  intermedia, 210.
Leng, Charles W., and Mutchler, Andrew J., supplement to preliminary list of the Coleoptera of the West Indies, 191–220.
Lepidosirenidæ, 735, 746.
Lepidotus **congolensis**, 761–765.
Lepipolys perscripta, 57.
Leptoceratops, 281.
Leptocypris, 748.
  modestus, 661, 702.
Leptodactylus lineatus, 795, 796.
  melanotus, 795, 796.
  mystacenus, 812.
Leptoglanis, 749.
Leptomeris æmulata, 90.
  lautaria, 90.
  ostentaria, 90.
  plantagenaria, 90.
  roseotincta, 90.
Leptostylus, 210.
  argentatus, 210.
  præmorsus, 210.
Leptotes theonus, 26.
Lepturges guadeloupensis, 210.
Lerema accius, 32.
Lerodea eufala, 34.
  loammi, 33.
  maculata, 33.
  osyka, 34.
Leucania luteopallens, 59.
Leuciscus, 748.
Leucoptera erythrinella, 146.
  guettardella, 146.
Leucothyreus vicentiæ, 208.
Leurognathus marmorata, 611.
Liacarus **fusiformis**, 161.
Ligyrus cordatus, 208.
  juvencus, 208.
Limnotherium, 843.
  tyrannus, 849.
Limochrœs arpa, 34.
  byssus, 34.
  palatka, 34.
  streckeri, 34.
  yehl, 34.
Lineodes contortalis, 119.
  integra, 119.
  interrupta, 119.
  triangulalis, 119.
Linura, 261, 262.
Lioderma interruptum, 203.
  quadridentatum, 203.
Lipoptycha maculana, 138.

Lispinus claviger, 198.
  impar, 198.
  insularis, 198.
Listropoda schmidlii, 559.
Litargus balteatus, 202.
Lithacodia bellicula, 67.
Lithocharis ochracea, 199.
Lithodytes, 794.
Litodonta hydromeli, 83.
Litolibrus princeps, 199.
Litoprosopus futilis, 77.
Loberus testaceus, 202.
Lobiopa insularis, 203.
Lobogestoria, 204.
Lomanaltes eductalis, 81.
Lophiodon, 576.
Lophodonta angulosa, 83.
Lower Animas Valley, geology of, 823-826.
Loxia megaplaga, 331.
Loxodon africanus, 865.
Loxostege albiceralis, 116.
  albiceralis var. floridalis, 116.
  dasconalis, 116.
  helvialis, 116.
  mancalis, 116.
  nasonialis, 117.
  similalis, 117.
Ludovix, 217.
Luperus placidus, 211.
Lussa abseuzalis, 57.
  filifera, 57.
Lycophotia incivis, 58.
Lycorea cleobæa, 21.
Lyctophilis foveicollis, 207.
Lyctus, 207.
Lygropia chromalis, 114.
Lygyrus fossulatus, 208.
Lymire, 344.
  albipennis, 344, 345.
  candida, 339, **344.**
  edwardsi, 46, 339, 344.
  fulvicollis, 344.
  melanocephala, 344, 345.
  metamelas, 344.
  senescens, 339, 344, **345.**
  strigivenia, 344.

Macaria æquiferaria, 94.
Macaria bisignata, 94.
  infimata, 94.
  maculifascia, 94.
  præatomata, 94.
  punctolineata, 94.
MacCallum, G. A., a new species of Trematode (*Cladorchis gigas*) parasitic in elephants, 865–870.
Machærhamphus anderssoni, 493.
Macraspis tristis, 208.
Macratria, 215.
Macromerus lanipes, 217.
Macrorhyncolus, 218.
Macrosiagon, 216.
  basalis, 216.
  cruentum, 216.
  discicolle, 216.
  sordidum var. major, 216.
Macrostola lutea, 203.
Macrothea unicoloralis, 123.
Madoryx pseudothyreus, 40.
Magusa dissidens, 57.
  orbifera, 57.
Malacopterygii, 735.
Malacosoma americana, 86.
  detritum, 211.
Malimbus, 261, 262, 263, 269.
  coronatus, 269.
  erythrogaster, 269.
  malimbicus, 270.
  nitens, 269.
  rubricollis centralis, 270.
  spinibarbis, 209.
Malopterurus, 750.
  electricus, 656, 657, 658, 662, **723.**
Mamestra capsularis, 59.
  erecta, 59.
  florida, 59.
  laudabilis, 59.
  lustralis, 59.
Manatha nigrita, 105.
Marasmalus basalis, 65.
  inficita, 65.
Marasmia cochrusalis, 111.
  floridalis, 112.
  trapezalis, 112.
Marathyssa ventilator, 65.
Marcusenius, 746.
  nigripinnis, 656, 657, 659, 661, **667.**

Marcusenius **osborni,** 654, 659, **667.**
  plagiostoma, 656, 657, 661, **669.**
  psittacus, 656, 657, 660, 661, **669.**
  pulverulentus, 657, **667.**
  retrodorsalis, 654, 659, **668.**
  tumifrons, 656, 661, **669.**
  wilverthi, 657, 661, **670.**
Marmara guilandinæ, 146.
Massala larina, 77.
Mastacembelidæ, 738, 752.
Mastacembelus, 752.
  congicus, 656, 658, 659, 660, 662, **733.**
Matthew, W. D., a Paleocene bat, 569–571; absence of the pollex in Perissodactyla, 573–577; the dentition of *Nothodectes*, 831–839.
Matthew, W. D., and Granger, Walter, the skeleton of *Diatryma*, a gigantic bird from the Lower Eocene of Wyoming, 307–326.
Medon cingulatus, 199.
Megadermidæ, 414, 486.
Megadytes fraternus, 196.
  giganteus, 196.
Megaloglossus woermanni, 482.
Megalops humeralis, 198.
  læviventris, 198.
  smithii, 198.
Megalopyge opercularis, 106.
Megapenthes sturmii, 205.
Megathymus cofaqui, 35.
  yuccæ, 35.
Megilla maculata, 200.
Megistops granulatus, 212.
Melalopha inclusa, 82.
  inclusa var. jocosa, 82.
Melanchroia cephise, 103.
  geometroides, 103.
  regnatrix, 103.
Melanolophia canadaria, 99.
Melanophila notata, 205.
Melanophthalma distinguenda, 204.
Melanopteryx, 261, 262, 263, 269.
  maxwelli, 269.
  nigerrimus, 269.
Melanthus brunnea, 28.
Melioptis famelica, 72.
  jucunda, 72.
Melioptis limbolaris, 72.
  sinualis, 73.
Melitara prodenialis, 131.
Melittia satyriniformis, 108.
Memythrus asilipennis, 110.
  palmii, 109.
  scepsiformis, 109.
  seminole, 110.
Menesta melanella, 142.
Meroptera pravella, 130.
Merostenus attenuatus, 209.
Merychippus, 574.
Mescina estrella, 131.
Meskea dyspteraria, 108.
Mesoborus, 747.
  crocodilus, 657, 658, 660, **684.**
Mesohippus, 574.
Mesomphalia ænea, 212.
  exclamationis, 212.
Mestra floridana, 15.
Metachroma cubæcola, 210.
  suffriani, 210.
  terminalis, 210.
Metamasius sericeus, 218.
Metanema quercivoraria, 101.
Metaponia obtusa, 69.
Methia punctata, 209.
Methorasa argentilinea, 71.
  cordata, 71.
  monetifera, 71.
Metriochroa psychotriatella, 146.
Micralestes, 655, 679, 747.
  acutidens, 656, 658, 660, **682.**
  altus, 656, 659, 660, **682.**
  stormsi, 656, 662, **682.**
Micranops brunneus, 199.
Micranthus, 751.
Microcausta flavipunctalis, 117.
Microligea **montana,** 330.
Micropteropus pusillus, 408, 412, **421, 510.**
Microsiphonorhis, 329.
  brewsteri, 329.
Microstomatichthyoborus, 654, **685,** 747.
  bashforddeani, 654, 660, **685.**
Microsynodontis, 749.
  batesii, 659, 719.
Microsyops uintensis, 854.

Microthrissa, 655, 676, 747.
Mieza igninix, 140.
Miller, Leo E., field notes on *Molothrus bonariensis* and *M. badius*, 579–592.
Mimetillus moloneyi, 410, 411, 412, 413, **446**, 486, **535**, 537.
Mimus saturninus modulator, 592.
Mineola indigenella nebulella, 129.
Miniopterus breyeri **vicinior**, 410, 411, 414, **450**, 487, **539**.
  inflatus, 410, 413, **451**, 487, **540–542**.
Minthea rugicollis, 207.
Minthoplagia rafaeli, 226.
Mioclænus opisthacus, 823.
  turgidus, 822, 823, 825.
Miohippus, 574.
Mirosternus lævis, 206.
Mitoura acis, 24.
  damon, 24.
Mixodectes, 825.
Mochocus, 750.
Molossidæ, 414, 486.
Molothrus badius, 590–592.
  bonariensis bonariensis, 580–590.
Monista personata, 198.
Monoclonius, 281, 285.
  cutleri, 289, 301–386.
  flexus, 287.
  nasicornus, 286–306.
Monocrepidius bifoveatus, 205.
Monodes trientiplaga, 56.
Monœdus, 201.
  guttatus, 201.
  lecontei, 201.
Monohammus titillator, 210.
Monoleuca obliqua, 106.
  subdentosa, 105.
  sulfurea, 105.
Monophyllus **frater**, 565.
Monoptilota nubilella, 129.
Mook, Charles C., criteria for the determination of species in the Sauropoda, with description of a new species of *Apatosaurus*, 355–360; fore and hind limbs of *Diplodocus*, 815–819.
Mops (Allomops) **faradjius**, 410, 414, **476**, 487, **557**.
  (Allomops) **nanulus**, 410, 413, 414, **477**, 558.
Mops (Allomops) **occipitalis**, 410, 411, 412, 414, **474**, **557**.
  (Allomops) **osborni**, 410, 412, 414, 470, **473**, 487, 491, **555**.
  congicus, 410, 412, 414, **467**, 487, **554**.
  midas, 410, 412, **466**, 487, **554**.
  nanulus, 487.
  niangaræ, 410, 413, 414, **468**, 487, **555**.
  occipitalis, 487.
  trevori, 410, 412, 414, 487, **469**, **555**.
Mordella scutellaris, 215.
Morio monilicornis, 195.
Mormyridæ, 735, 746.
Mormyrops, 746.
  attenuatus, 656, 657, 659, 660, 661, **667**.
  breviceps, 655, 657, **666**.
  deliciosis, 656, 657, 660, 661, **666**.
  masuianus, 666.
  microstoma, 657, **666**.
  sirenoides, 656, 657, 659, 660, **666**.
Mormyrus, 746.
  bumbanus, 656, 657, 661, **673**.
  caballus, 656, 657, 661, **674**.
  ovis, 656, 657, 661, **673**.
  proboscirostris, 661, **674**.
  rume, 661, **674**.
Moropus, 576.
Morrisonia confusa, 59.
  mucens, 59.
  rileyana, 59.
  sectilis, 59.
Munia, 261, 262, 263, 274.
  oryzivora, 248, 274.
Murphy, Robert Cushman, a new albatross from the west coast of South America, **861–864**.
Musicoderus nigrocoeruleus, 198.
Mutchler, Andrew, J., see Leng, Charles W.
Myelois bistriatella, 128.
  dulciella, 128.
  duplipunctella, 128.
  obnupsella, 128.
  oporedestella, 129.
  transitella, 128.
Myliobatis **dispar**, 765.

Myochrous brevicornis, 211.
  denticollis, 211.
Myomyrus, 746.
  macrodon, 657, 659, 661, **670.**
  macrops, 656, 657, **670.**
Myonycteris wroughtoni, 408, 412, **422, 511.**
Myopterus albatus, 406, 410, 413, **453,** 487, **543.**
Myotis bocagii, 487, 489.
  bocagii bocagii, 409, 412, **439,** 487, **527.**
  bocagii cupreolus, 409, 411, 412, **440,** 486, **528.**
  bocagii hildegardeæ, 409, 411, **440,** 487, **529.**

NACERDA, 215.
Nacoleia hampsoni, 113.
Nacophora phigaliaria, 100.
  quernaria, 100.
  ypsilon, 100.
Nandidæ, 750.
Nannalthiops, 747.
Nannæthiops tritæniatus, 659, **686.**
Nannocharax, 748.
  brevis, 661, **688.**
  elongatus, 656, 658, 660, **689.**
  fasciatus, 656, **688.**
  tænia, 658, 659, 660, **689.**
Nannochromis, 750.
  squamiceps, 655, 662, **730.**
Napata chalybea, 339.
Nathalis iole, 9.
Natrix septemvittata, 627.
  sipedon, 628.
Nausibius dentatus, 202.
Nealyda kinzelella, 142.
  pisoniæ, 142.
Necrosorex, 833.
Negetia formosalis, 47.
Neisna, 262.
Nelicurvius, 261, 262, 263, 271.
  nelicourvi, 271.
Nemachilus, 748.
Nematidium mustela, 201.
Nemognatha, 216.
Nemoria auranticolorata, 88.
  mimosaria, 87.
Nemosoma, 204.
Neoarchytas inambarica **aurifrons,** 228.
Neoborus, 747.
Neochmia, 261, 262.
Neocyphus pudens, 216.
Neodavisia singularis, 127.
Neolebias, 747.
Neonympha gemma, 19.
  phocion, 19.
Neoplagiaulax molestes, 821.
Neoplynes eudora, 48.
Nephopterx pergratialis, 130.
Nephopteryx furfurella, 130.
Nepytia fumosaria, 95.
Neshyphantes, 263.
Nesocharis, 252, 261, 278.
  capistrata, 245, 278.
Niauchenoglanis, 749.
Nichols, John Treadwell, ichthyological notes from a cruise off southwest Florida, with description of *Gobiesox yuma,* p. **873–877.**
Nichols, John Treadwell, and Griscom, Ludlow, fresh-water fishes of the Congo Basin obtained by the American Museum Congo Expedition, 1909–1915, 653–756.
Nigrita, 261, 262, 263, **274.**
  brunnescens saturatior, 274.
  canicapilla, 274.
  fusconota, 245, 275.
  luteifrons, 274.
Noble, G. K., the systematic status of some Batrachians from South America, 793–814.
Noctua lubricans, 58.
  spreta, 58.
Noda fusca, 210.
  luteicornis, 210.
Nola laguncularıæ, 47.
Nomophila noctuella, 116.
Nonagria oblonga, 61.
Noropsis hieroglyphica, 63.
Notharctinæ, 842.
Notharctus, 845.
  affinis, 843, 848, **850.**
  anceps, 843, 847, **849.**
  crassus, 843, **854.**
  matthewi, 845.

Notharctus nunienus, 843, **845.**
osborni, 843, 846, **848.**
pugnax, 843, **853.**
sp., 846.
tenebrosus, 843, 844, **851.**
tyrannus, 843, 844, **851.**
uintensis, **856.**
venticolus, 843, 844, **846.**
Nothodectes, 831–839.
dubius, 931.
gidleyi, 832–836.
sp., 828.
Nothopleurus maxillosus, 209.
Notiospiza, 261, 262.
Notoglandium, 749.
Notopteridæ, 735, 746.
Notopterus, 746.
Notopthalmus viridescens, 620.
Nycteridæ, 414, 486.
Nycteris arge, 409, 411, 412, **426,** 486, 495, **519.**
avakubia, 409, 411, 413, **426,** 486, **519.**
grandis, 406.
hispida, 406, 409, 411, 412, 413, 425, **487, 517.**
major, 409, 411, 412, 427, **487, 520.**
pallida, 409, 411, 413, **425,** 487, 489, **518.**
Nycticejus schlieffenii, 447.
Nyctinomus aloysii-sabaudiæ, 487.
ansorgei, 410, 411, **453,** 487, 495, **543.**
cisturus, 410, 413, **455,** 487, **545.**
frater, 414, 487.
leonis, 410, 412, **454,** 487, **544.**
midas, 466.
ochraceus, 410, 412, 414, **455,** 487, **545.**
Nymphula allionealis, 120.
australis, 120.
hyralis, 120.
icciusalis, 120.
maculalis, 119.
maculalis var. fœminalis, 119.
maculalis var. masculinalis, 119.
Nympula nebulosalis, 120.
nomophilalis, 120.
obliteralis, 120.
Nympula obscuralis, 120.
Nyridela acroxantha, 345.
chalciope, 339, 345.
xanthocera, 345.

OCALA dryadella, 132.
Ochlodes sassacus, 32.
Odaxothrissa, 676, 747.
ansorgii, 657, **677.**
losera, 661, **677.**
Odontaspis macrota, 765.
Œdionychis cyanipennis, 211.
Œstrogaster fumosus, 223.
Œstrogastrodes similis, 223.
Ogdoconta cinereola, 65.
Oiketicus abbotii, 104.
Olene achatina, 85.
atomaria parallela, 85.
basiflava meridionalis, 85.
cinnamomea, 85.
leucophæa, 85.
manto, 85.
plagiata, 85.
Olethreutes andromediana, 137.
devotana, 137.
rosaochreana, 137.
Oligia agrotina, 56.
chalcedonia, 55.
exesa, 55.
festivoides, 55.
fuscimacula, 55.
grata, 55.
nucicolora, 55.
Oligostigma seminealis, 120.
vittatalis, 120.
Omalodes klugi, 203.
ruficlavis, 203.
Ommaleskia, 227.
fumosa, 227.
Omoplata distincta, 212.
Omototus fulvopubescens, 211.
Omphalocera cariosa, 122.
Onchosaurus, 759.
mira, 759.
pharao, 759.
Oncideres amputator, 210.
Onychocerus scorpio, 210.
Oosternum costatum, 197.
Opharus bimaculata, 340.

Ophideres apta, 77.
Ophiocephalidæ, 738, 752.
Ophiocephalus, 752.
  obscurus, 657, 658, 659, 660, 662, **733.**
Ophiomedon anthracinus, 198.
Opsophasiopteryx, 222.
  mima, 223.
Oreodon, 573, 574.
Oreopeleia **leucometopius,** 327.
Oreta odona, 86.
Oribata **quadrisetosa,** 161.
Oribatella achipteroides var. **australis,** 160.
Oribatula **clavata,** 162.
Orthonana ceutrostrigaria, 93.
  obstipata, 92.
Orthosia aurantiago, 61.
  chlorophora, 61.
Orthosoma brunneum, 209.
Ortygospiza, 261, 262.
Oryzornis, 262.
Osorius fauveli, 198.
Ospromenidæ, 738, 751.
Ostariophysi, 736.
Osteoglossidæ, 735, 746.
Othyphantes, 261, 262, 263, 270.
  baglafecht, 270.
Otomops martiensseni, 406.
Oxydia vesulia, 102.
Oxydrepanus rufus, 195.
Oxynodera variegata, 212.
Oxytelus insignitus, 198.
Ozognathus, 206.

PACHNÆUS citri, 216.
  marmoratus, 216.
Pachydrus obniger, 196.
Pachylia ficus, 40.
  resumens, 40.
Pachyotus altilis, 410, 411, **447,** 487, **538.**
  nigrita nux, 410, 412, **447,** 486, **538.**
Pachyphantes, 261, 263.
  superciliosus, 267, 268.
Pachyzancla bipunctalis, 116.
  periusalis, 116.
  phæopteralis, 116.
Pæctes abrostoloides, 65.
Pæctes devincta, 65.
  lunodes, 65.
  oculatrix, 65.
  pygmæa, 65.
Pæderus thoracicus, 198.
Palaminus coriaceus, 198.
  insularis, 198.
Palatka nymphæella, 132.
Palpidia pallidior, 48.
Palthis asopialis, 81.
Paludipasser, 259, 261.
Palyas auriferaria, 102.
Panagæus fasciatus, 195.
  quadrisignatus, 195.
  thomæ, 195.
Panapoda rufimargo carneicosta, 75.
Pangrapta decoralis, 71.
Panthea furcilla, 52.
Pantodon, 746.
  buchholzi, 657, **674.**
Pantodontidæ, 735, 746.
Pantographa limata, 114.
Pantolambda, 573.
  cavirictus, 823.
Panula inconstans, 72.
  remigipila, 72.
Papilio andræmon bonhotei, 6.
  aristodemus, 6.
  celadon, 8.
  cresphontes, 6.
  devilliers, 5.
  glaucus, 6.
  glaucus var. australis, 6.
  glaucus var. turnus, 6.
  marcellus, 7.
  marcellus var. floridensis, 8.
  marcellus var. lecontei, 8.
  marcellus var. telamonides, 8.
  palamedes, 7.
  philenor, 5.
  polydamus, 5.
  polyxenes asterias, 5.
  ponceana, 6.
  thoas, 5.
  troilus, 7.
  troilus var. texanus, 7.
Parachma nua, 123.
  ochracealis, 123.
Paradosis flegia, 114.

Paragrotis messoria, 58.
  tessellata, 58.
Parailia, 749.
  longifilis, 662, 710.
Paralindria partita, 203.
Parallelia bistriaris, 75.
Paramphilius, 749.
Paramphistomum aspidonectes, 866.
  papillostomum, 866.
Paramys, 574.
Parandra lævis, 209.
Paraphago, 747.
Paraphasiopsis, 232.
  mellicornis, 232,
Paraphractura, 750.
  tenuicauda, 662, **723.**
Paratactopsis, 230.
  setosa, 230.
Paratheresia **brasiliensis,** 222.
Paratilapia, 750.
  longipinnis, 655, 658, **728.**
  macrocephala, 660, **727.**
  xenodon, 655, 660, **729.**
Paratrytone howardi, 33.
Parauchenoglinis, 749.
Paretroplus, 751.
Paridæ, 262.
Parodomyia, 225.
  paradoxica, 226.
Parmoptila, 254, 261, 262, 263, **274.**
  jamesoni, 245, 255, **274.**
  woodhousei, 274.
Paromalus parallelus, 203.
Passalus interruptus, 207.
  tlascala, 207.
  unicornis, 207.
Patalene infensata, 102.
  olyzonaria, 102.
  siculata, 102.
  syzygiaria, 102.
Patissa flavicostella, 123.
  flavifascialis, 123.
  sordidalis, 123.
  vestaliella, 123.
  xantholeucalis, 123.
Pelecopselaphus strictus, 205.
Pellonula, 676, 747.
  acutirostris, 661, **675.**
  congica, 656, 659, 661.
Pellonula (Microthrissa) royauxi, **677.**
  (Pœcilothrissa) congica, 676.
  royauxi, 656, 659, 661.
  tenuis, 654, 656, 661, **675.**
  vorax, **675.**
Pelmatochromis, 751.
  lateralis, 656, 658, 660, 662, **730.**
Peloribates **iowaensis,** 160.
Pelosoma, 197.
Pelycodus, 841.
  frugivorus, 841, 857.
  jarovii, 857.
  ralstoni, 841, 857.
  trigonodus, 841, 857.
  tutus, 857.
Penicillidia fulvida, 559.
  senegalensis, 559.
Pentacodon, 825.
Pentomacrus fasciatus, 209.
Peoria approximella, 134.
Peosina pandrosa, 79.
Percnoptilota fluviata, 92.
Perdita, 241.
  (Alloperdita) **novæangliæ,** 241.
  (Cockerellia) **bequærti,** 241.
  halictoides, 241.
Peridinetus maculatus, 217.
  poeyi, 217.
Peridroma digna, 58.
  infecta, 58.
  margaritosa, 58.
Perigea apameoides, 55.
  cervina, 55.
  concisa, 55.
  cupentia, 55.
  epopea, 55.
  icole, 55.
  pulverulenta, 55.
  selenosa, 55.
  sutor, 55.
  vecors, 55.
  xanthioides, 55.
Periogonia lusca interrupta, 41.
Periptychus carinidens, 823, 828.
  rhabdodon, 822, 825.
  rhabdodon var. fissus, 823.
  sp. nov., 828.
Perissodactyla, absence of the pollex in, 573–577.

Pero honestarius, 102.
Perrisodus, 751.
Petalia arge, 426.
  major, 427.
Petalium pulicarium, 206.
Petersius, 655, 679, 747.
  caudalis, 656, **683.**
  hilgendorfi, 657, **683.**
  occidentalis, 655, 656, 658, 660, 661, **683.**
  woosnami, 656, 658, 659, 660, 661, **683.**
Petrocephalus, 746.
  ballayi, 661, **667.**
  sauvagii, 656, 657, 659, 660, 661, **667.**
  simus, 656, 657, 659, 661, **667.**
Petrochromis, 750.
Phacellodomus rufifrons, 592.
Phæcasiophora confixana, 137.
Phænonotum, estriatum, 197.
Phænotypus palmarum, 197.
Phæocyma æruginosa, 78.
  benesignata, 78.
  calycanthata, 79.
  cingulifera, 79.
  curema, 78.
  declarans, 79.
  edusina, 78.
  exhausta, 78.
  fictilis, 78.
  lunata, 78.
  obliqua, 78.
  sexplagiata, 79.
  undularis, 78.
  viridans, 78.
Phago, 747.
  boulengeri, 658, 659, **684.**
  intermedius, 660, **684.**
Phaleria variabilis, 213.
Phalonia angulatana, 140.
  bomonana, 140.
  bunteana, 140.
  ziscana, 140.
Pharmacis sartana, 140.
Phaulex albipes, 649.
Phenacodonts, 828.
Phenacodus, 573.
Phenacolemur, 833, 837.
Philagraula slossoniæ, 103.
Philetairus, 251, **252–254,** 261, 262, 263, 267.
  socius, 252, 253, 267.
Philhydrus melanocephalus, 197.
  nebulosus, 197.
  ochracea, 197.
Philothermus puberulus, 201.
Phiprosopus callitrichoides, 67.
Phlæotrya mexicana, 215.
Phlyctænia desistalis, 117.
  ferrugalis, 117.
  helvalis, 117.
  tertialis, 117.
Phoberia atomaris, 75.
Phocides batabano, 26.
Phœbis agarithe, 10.
  argante, 10.
Pholidornis, 261, 262, 263.
Pholus achemon, 42.
  fasciatus, 42.
  labruscæ, 42.
  pandorus, 41.
  satellitia posticatus, 41.
  vitis, 42.
Phormoplectes, 261, 262, 270.
  herberti, 270.
Phororhachos, 307.
Phractolæmidæ, 735, 747.
Phractolæmus, 747.
Phractura, 750.
  schapirhynchura, 659, 723.
Phrudocentra centrifugaria, 87.
Phrygionis argentiostriata, 103.
Phthinolophus indentanus, 138.
Phthiracarus **pectinatus,** 165.
Phurys bistrigata, 76.
  campanilis, 76.
  lima, 76.
  perspicua, 76.
  vinculum, 76.
Phycanassa viator, 33.
Phyciodes phaon, 14.
  tharos, 14.
Phyllocnistis intermediella, 146.
Phyllomedusa iheringii, 811.
Phyllonemus, 749.
Phyllonycteris **major, 567.**
Phyllophaga (Lachnosterna) patruelis, 208.

Phyllops **vetus,** 337.
Physalia, 749.
Physeter (Euphysetes) simus, 362.
Physonota gigantea, 212.
Piesmopoda filiolella, 129.
  subrufella, 129.
Pigmeophorus **quadratus,** 166.
Piletocera bufalis, 121.
  simplicialis, 121.
Pilocrocis inguinalis, 112.
  plumbicostalis, 112.
  ramentalis, 112.
  tripunctata, 112.
  tristigmalis, 112.
Pinipestis amatella, 129.
Pinophilus latipes, 198.
  vermiformis, 198.
Pipistrellus **abaensis,** 409, 411, 413, **442,** 487, **531.**
  musciculus, 409, 411, **443,** 482, 486, 489, **532.**
  nanus, 409, 411, 412, 413, **441,** 487, 489, **529–531.**
Plathypena scabra, 81.
Platœceticus gloveri, 105.
Platychora labasi, 203.
Platydema antematum, 214.
  apicale, 214.
  picicorne, 214.
Platynota flavedana, 139.
  metallicana, 139.
  rostrana, 139.
  tinctana, 139.
Platyptilia crenulata, 135.
  edwardsii, 135.
Platysenata videns, 54.
Platytæniodus, 751.
Platytes punctilineella, 126.
Plecodus, 751.
Plectromerus dentipes, 209.
Pleonectyptera albococtaliata, 67.
  geometralis, 67.
  habitalis, 67.
  pyralis, 67.
Plesiadapidæ, 833.
Plesiadapis, 833, 836.
Plestiodon quinquelineatus, 627.
Plethodon æneus, 602.
  dorsalis, 602.
Plethodon erythronotus, 602, **606.**
  glutinosus, 603.
  jordani, 602.
  metcalfi, 602, **604.**
  shermani, 602.
  wehrlei, 602.
  yonahlossee, 598–603.
Pleurasympieza smithii, 57.
Pleuroprucha insulsaria, 88.
Ploceëlla, 261, 262, 268.
  javanensis, 368.
Ploceidæ, **243–280**: proposed classification of, 261; Reichnow's classification of, 262; Shelly's classification of, 263.
Ploceinæ, 243, 244, 251, 261, 262, 263; dry-season or winter plumages in, 259.
Plocepasser, 261, 262, 263, 266.
  mahali, 266.
  melanorhynchus, 266.
  superciliosus, 266.
Ploceus, 261, 262, 263, 268.
  baya, 268.
  manyar, 268.
Plusia ærea, 64.
Plutella maculipennia, 141.
Poaphila contempta, 76.
  deleta, 76.
  erasa, 76.
  herbicola, 76.
  pacalis, 76.
  quadrifilaris, 75.
  turbata, 76.
Podiasa chiococcella, 146.
Pœcilothrissa, 655, 677.
Poephila, 261, 279.
  gouldiæ, 279.
Polycentropsis, 750.
Polycesta angulosa, 205.
  porcasta, 205.
  thomæ, 205.
Polyderces zonatus, 217.
Polygaster **brasiliensis,** 224.
Polygonia interrogationis, 15.
Polygrammata hebraica, 54.
Polyhymno luteostrigella, 141.
Polypteridæ, 734, 746.
Polypterus, 746.

Polypterus congicus, 657, 661, **664.**
    ornatipinnis, 656, 657, 662, **664.**
    palmas, 657, 661, 662, **665.**
Pontia monuste, 8.
    monuste var. phileta, 9.
    protodice, 9.
    rapæ, 9.
Poospiza melanoleuca, 589.
    whitii, 588, 589.
Porrima sanguinea, 62.
Potamothrissa, 655, 677.
Pre-Cambrian and Triassic diabase in eastern Pennsylvania, 173–181.
Prenes nero, 35.
    ocola, 35.
    panoquin, 35.
    panoquinoides, 35.
Prepodes, 216.
Prionapteryx achatina, 125.
    nebulifera, 125.
Prionoxystus robiniæ, 108.
Pristis pectinatus, 876.
Prochalia pygmæa, 105.
Prodenia commelinæ, 56.
    dolichos, 56.
    eridania, 56.
    ornithogalli, 56.
    ornithogalli var. eudiopta, 56.
Prodoxus quinquepunctella, 146.
Prolabia, **643.**
    arachidis, 636.
    dominicæ, 636, **643.**
    jamaicana, 636, **645.**
    unidentata, 636, **647.**
Prolimacodes badia argentimacula, 106.
Pronuba yuccasella, 146.
Proroblemma testa, 69.
Proserpinus guaræ circæ, 42.
Prostemodes dominicensis, 209.
Prosternodes cinnamipennis, 209.
Prostomeus brunneus, 142.
Protambulyx carteri, 39.
    rubripennis, 38.
    strigilis, 38.
Protapirus, 576.
Prothymia rhodarialis, 67.
    semipurpurea, 68.
Protogonodon, sp. nov., 822.
Protoparce brontes cubensis, 37.
Protoparce quinquemaculata, 37.
    rustica, 37.
    sexta, 37.
Protopterus, 746.
    dolloi, 657, 659, **665.**
Psalis americana, 635, **637.**
    buscki, 637.
    colombiana, 637.
    distincta, 637.
    gagathina, 637.
    procera, 637.
    robusta, 637.
Psaphidia resumens, 57.
Pseudanaphora arcanella, 147.
Pseudanarta aurea, 57.
Pseudanthrœcia coracias, 78.
Pseudomus semicribratus, 217.
Pseudomya minima, 45.
Pseudonigrita, 261, 262, 266.
    arnaudi, 266.
Pseudospermestes, 261.
Pseudosphinx tetrio, 39.
Psiloptera aurifera, 205.
Psittacotherium, 822.
Psychomorpha epimenis, 63.
    euryrhoda, 63.
Psyllobora lineola, 200.
    nana, 200.
Pterætholix bullula, 65.
Pterocharis eggersi, 194.
Pterophorus bipunctatus, 135.
    cervinicolor, 136.
    inquinatus, 136.
    kellicottii, 135.
    monodactylus, 135.
    perplexus, 136.
    rhynchosiæ, 135.
    simplicius, 136.
    unicolor, 136.
Pteropus edulis, 482.
    haldemani, 421.
Ptinus niveicollis, 206.
Pyanisia tristis, 214.
    undata, 214.
Pygarctia abdominalis, 51.
    grossbecki, 51.
    vivida, 51.
Pyragra buscki, 636.
Pyragropsis buscki, 635, **636.**

Pyralis farinalis, 122.
  manihotalis, 122.
Pyrausta acrionalis, 118.
  æglealis, 118.
  illibalis, 118.
  inornatalis, 119.
  laticlavia, 118.
  orphisalis, 118.
  oxydalis, 118.
  penitalis, 118.
  phœnicealis, 118.
  signatalis, 119.
  submedialis, 118.
  theseusalis, 118.
  thestealis, 118.
  tyralis, 119.
Pyrenestes, 261, 262, 263, 276.
  ostrinus, 276.
  ostrinus gabunensis, 276.
Pyrgus tessellata, 28.
Pyromelana, 261, 262, 263, 272.
  flammiceps, 272.
  oryx, 272.
Pyromorpha centralis, 107.
Pyrophila tragopoginis, 56.
Pyrophorus longipennis, 205.
Pytilia, 261, 262, 263, 276.
  melba belli, 276.
  phænicoptera emini, 276.

Quelea, 245, 261, 262, 263, 272.
  æthiopica, 272.
  cardinalis, 272.
  quelea, 272.

Racheospila atrapes, 87.
  catachloa, 87.
  cupidenaria, 87.
  extremaria, 87.
  gerularia, 87.
  hollandaria, 87.
  jaspidiaria, 87.
  lixaria, 86.
  rubrolinearia, 87.
  saltusaria, 88.
  sitellaria, 87.
  viridipurpurea, 87.
Rana catesbeiana, 623.
  clamitans, 623.
Rana opisthodon, 812.
  palustris, 623.
Raphygnathus **pectinatus,** 151.
Rasbora, 748.
Rehn, James A. G., and Hebard, Morgan, studies in West Indian earwigs (Dermaptera), 635–651.
Reichenowia, 261, 262.
Remigia repanda, 75.
  repanda var. disseverans, 75.
  repanda var. marcida, 75.
Renia fraternalis, 80.
  salusalis, 80.
  sobrialis, 80.
  sobrialis var. larvalis, 80.
Rhabdoides cellus, 27.
Rhabdoptera picipes, 211.
Rhacius sulcatulus, 214.
Rhacophorus schlegeli, 812.
Rhantus calidus, 196.
Rhaphidorrhynchus nitidicollis, 218.
Rhinolophidæ, 414, 486.
Rhinolophus **abæ,** 409, 411, 413, **428,** 487, **523.**
  axillaris, 409, 411, 413, **429,** 487, **523.**
  hildebrandti eloquens, 409, 410, **428,** 487, **522.**
Rhinopoma microphyllum, 488, 495.
Rhinoptera sp., 766.
Rhipidandrus micrographus, 213.
Rhipidophorus, 216.
Rhipiphorus sordidium, 216.
Rhizopertha pusilla, 207.
Rhizophagus heydeni, 203.
Rhodophora gauræ, 62.
Rhombodera bicolor, 195.
  flavipes, 195.
Rhothonia, 861.
Rhynchophorus palmarum, 218.
Rœselia minuscula, 47.
Rupela albinella, 123.
  unicolor, 124.
Rutela formosa, 208.

Sabulodes politia, 102.
  transversata, 102.
Saccolaimus peli, 406, 407, 408, 411, 412, 413, **424,** 482, 486, **515,** 559.

Sacium instabile, 199.
Salebria afflictella, 130.
  celtidella, 130.
  georgiella, 130.
  slossonella, 130.
Salia interpuncta, 81.
Salmo, 747.
Salmonidæ, 747.
Salpornis salvadori, 259.
Samea ecclesialis, 112.
  multiplicalis, 112.
Samia cecropia, 43.
Sannina uroceriformis, 109.
Sarasota plumigerella, 128.
Sarcodaces, 747.
  odoë, 656, 657, 659, 660, 661, 662, **677.**
Satyrodes canthus, 18.
Scelolophia crossii, 89.
  pannaria, 89.
  purpurascens, 89.
  rubrotincta, 89.
Sceloporus undulatus, 627.
Scelorthus pisoniella, 144.
Scepsis fulvicollis, 46.
Schilbe, 749.
  congolensis, 656, 659, 660, **710.**
  mystus, 657, 658, 662, **709.**
Schinia arefacta, 62.
  espea, 62.
  lynx, 62.
  marginata, 62.
  meskeana, 62.
  petulans, 62.
  saturata, 62.
  trifascia, 62.
  tuberculum, 62.
Schizotherium, 576.
Schizura apicalis, 84.
  concinna, 84.
  ipomϾ, 84.
  semirufescens, 84.
Schœnobius melinellus dispersellus, 124.
  unipunctellus, 124.
  sordidellus, 124.
  tripunctellus, 124.
Schubotzia, 751.
Schulte, H. von W., the skull of *Kogia breviceps*, 361–404; a note on the lumbar vertebræ of *Scutisorex*, 785–792.
Sciagraphia aucillaria, 94.
  continuata, 93.
  granitata, 93.
  simulata, 94.
Sciocharella pertenuis, 199.
Sciocharis bakeri, 199.
Scirophaga consortalis, 124.
  perstrialis, 124.
Scirus simplex, 150.
Scolecocampa liburna, 66.
Scopæus angusticollis, 199.
  antennalis, 199.
  auripilis, 199.
  marginatus, 199.
  simpliciollis, 199.
  umbra, 199.
Scoparia basalis, 122.
  strigalis, 122.
Scoteinus schlieffenii, 410, 413, **447,** 487, **536.**
Scotophilus altilis, 447.
  nigrita nux, 447.
  nux, 406.
Scotozous rüppelii, 409, 413, **443**, 486, **533.**
  tenuipinnis, 486.
Scutisorex congicus, skeletal characters, 769–781.
  field notes on, 781–783.
  lumbar vertebræ, 785–792.
  taxonomic status, 781.
Scymnus loewii, 200.
  ochroderus var. cyanipennis, 200.
  thoracicus, 200.
Scythris trivinctella, 144.
Seirarctia echo, 51.
Selenis monotropa, 78.
Selenophorus aeneocupreus, 194.
  alternans, 194.
  chalybæus, 194.
  cuprinus, 194.
  discopunctatus, 194.
  falvilabris, 194.
  integer, 194.
  parumpunctatus, 194.
  propinquus, 194.
  pyritosus, 194.

Selenophorus sinuatus, 194.
Selidosema **cypressaria,** 96.
  humarium, 96.
  insaria, 99.
  muricolor, 99.
Semnopsyche diana, 14.
Seneca tumidulella, 131.
Senta enervata, 54.
Sericoptera virginaria, 100.
  virginaria var. vestalis, 100.
Sesia fadus, 41.
  tantalus zonata, 41.
Setiostoma xanthobasis, 141.
Sharpia, 263.
Siavana repanda, 75.
Sibine stimulea, 105.
Sigela basipunctaria, 69.
  penumbrata, 69.
Siluranodon, 749.
Siluridæ, 736, 748, 749.
Silvanus rectus, 201.
  surinamensis, 201.
Simochromis, 750.
Simyra albovenosa, 54.
Sinoxylon floridanum, 207.
Sisyrhypena orciferalis, 80.
Sitagra, 261, 262, 263, 268.
  heuglini, 268.
  luteola, 268.
  monacha, 268.
  tænioptera, 268.
Slossonella tenebrosa, 106.
Smicrips hypocoroides, 203.
Smith, Herbert H., see Townsend, Charles H. T.
Solenoptera, 209.
Sparganothis taracana, 139.
Spathodus, 751.
Spelerpes bislineatus, 618.
  ruber ruber, 616.
  ruber schencki, 613–616.
Spermestes, 262, 273.
  cucullata, 273.
  poensis stigmatophora, 273.
Spermestinæ, 244, 262.
Spermophagus hoffmanseggi, 213.
Spermospiza, 244, 252, 261, 262, 263, 275.
  guttata, 275.
Spermospiza poliogenys, 275.
Sphæcelodes vulneraria, 103.
Sphenophorus liratus, 218.
  longicollis, 218.
  quadrisignatus, 218.
  sacchari, 218.
  sordidus, 218.
Sphida anoa, 61.
  obliqua, 60.
Sporæginthus, 261, 277.
  subflavus, 277.
Sporopipes, 261, 262, 263, 266.
  frontals, 266.
  squamifrons, 266.
Spragueia dama, 70.
  leo, 70.
  onagrus, 70.
  transmutata, 70.
Staganopleura, 261, 262.
Stamnoderus apicalis, 198.
  bernhaueri, 198.
  dissimilis, 198.
  varians, 198.
Staphylus hayhurstii, 28.
Stappersia, 751.
Statina roseotinctella, 134.
Steatocranus, 750.
  gibbiceps, 662, 727.
Steganura, 258, 261, 262, 280.
  paradisea, 258, 280.
Steirastoma depressum, 210.
Stelidota geminata, 203.
  ruderata, 203.
Stenia indianalis, 121.
Steniodes gelliasalis, 122.
Stenodontes exsertus, 209.
Stenophyes huronalis, 116.
Stenoptilia pallistriga, 137.
Stenoptycha pterophoralis, 119.
Stenotrachelys approximaria, 96.
Stenous tibialis, 195.
Stenus (Mesotenus) lucens, 198.
Stephanoderes cubensis, 219.
  depressus, 219.
  elongatus, 219.
  flavicollis, 219.
  gossypii, 219.
  minutus, 219.
  nitidipennis, 219.

Stephanoderes nitidulus, 219.
    obesus, 219.
    obliquus, 219.
    opacifrons, 219.
    setosus, 219.
    squamosus, 219.
    subconcentralis, 219.
    subopacicollis, 219.
    unicolor, 219.
Sternechus, 216.
    pectoralis, 216.
    vicinus, 217.
Stethoxus insularis, 197.
    intermedius, 196.
Stictospiza, 261, 262.
Stigmella condaliafoliella, 145.
    myricafoliella, 145.
Stilicopsis auripilis, 198.
    circumflexus, 198.
Stilicus agnatus, 198.
    cupreus, 198.
    insularis, 198.
    jucundus, 198.
Stizocera, 209.
Stizoptera, 261.
Stomatorhinus, 746.
    humilior, 661, 670.
    microps, 657, 661, 670.
Stomyles celia, 33.
    fusca, 33.
    textor, 33.
Storeria occipitomaculata, 629.
Strategus julianus, 208.
    syphax, 208.
    tricornis, 208.
Stratiotes iracundus, 195.
Strymon titus, 25.
Styracopus phaseoli, 217.
Styracosaurus, 281.
Sufetula diminutellus, 110.
Sycobrotus, 263.
Sylectra erycata, 71.
Sylepta elevata, 114.
    fluctuosalis, 114.
    masculinalis, 114.
    obscuralis, 114.
    penumbralis, 114.
Sylviidæ, 263.
Sylvilagus gabbi **consobrinus,** 335.
Sylvilagus somereni, 769.
Symmerista albifrons, 83.
Symplectes, 261, 262.
Synanthedon exitiosa, 108.
    exitiosa var. fitchii, 108.
    floridensis, 109.
    geliformis, 109.
    marica, 109.
    pictipes, 109.
    pyri, 109.
    ruficornis, 109.
    sapygæformis, 109.
    seminole, 109.
    texana, 109.
Synchita granulata, 201.
    laticollis, 201.
Synchlora ærata, 87.
    denticularia, 87.
    hulstiana, 87.
    xysteraria, 87.
Synclera traducalis, 111.
Syneda faceta, 73.
    graphica, 73.
    graphica var. media, 73.
Synelys enucleata, 89.
    nigrocandida, 89.
    subquadrata, 89.
    timandrata, 89.
    umbilicata, 89.
Synodontis, 749.
    acanthomias, 656, 658, 660, 662, **716.**
    afro-fischeri, 655, 658, 660, 662, **716.**
    alberti, 657, 662, **718.**
    angelicus, 662, **717.**
    decorus, 656, 657, 658, 660, 662, **719.**
    depauwi, 656, 657, 658, 660, 662, **717.**
    greshoffi, 656, 658, 660, 662, **718.**
    longirostris, 662, **717.**
    notatus, 657, 662, **719.**
    pleurops, 656, 658, 660, 662, **719.**
    soloni, 662, **717.**
    tenuis, 655, **717.**
Syntomeida epilais jucundissima, 45.
    ipomeæ, 45.
Syringosoma, 232.
    pennipes, 233.

TACHYRIS margarita, 8.
  margarita var. neumoegenii, 8.
Tachys picturatus, 194.
Tachyta autumnalis, 194.
Tæniopygia, 261, 262.
Tæniotes scalaris, 210.
Tallula atrifascialis, 128.
Tampa dimediatella, 134.
Tanagra bonariensis, 580.
Taphozous mauritianus, 406, 408, 411, 412, 413, **423**, 487, 490, 495, **513.**
  peli, 424.
  sudani, 408, 411, **423**, 487, **514.**
Tarache aprica, 70.
  aprica var. ceyvestenis, 70.
  biplaga, 70.
  candefacta, 70.
  delecta, 70.
  quadriplaga, 70.
  tenuscens, 70.
  terminimaculata, 70.
  tetragona, 70.
Tegeocranus **subniger,** 163.
Tegoribates, 158.
  subniger, 159.
Telea polyphemus, 44.
Teleoceras, 576.
Teleostean vertebra, 766.
Telephanus cribratus, 201.
  strictus, 201.
Telmatochromis, 751.
Telmatolestes, 843.
  crassus, 852.
Temnochila hubbardi, 204.
Tenebroides transversicollis, 204.
Tenuipalpus **erythreus,** 152.
Terastia meticulosalis, 115.
Terias blakei, 12.
Terrapene carolina, 626.
Tetanolita mynesalis, 80.
  palligera, 80.
Tetrabothynus, 216.
Tetracha acutipennis, 193.
  carolina, 193.
  carolina var. occidentalis, 193.
  sobrina, 193.
  sobrina var. antiguana, 193.
  sobrina var. infuscata, 193.
Tetraclænodon, 822, 825.
Tetrænura, 261, 262.
Tetralopha querciella, 128.
  robustella, 128.
  subcanalis, 128.
Tetraonyx 4-maculatus, 216.
Tetrodon mbu, 658, 659, 660, 662, **733.**
  miurus, 662, **734.**
Textor, 262, 263, 265.
  albirostris, 249–250, 265.
  albirostris intermedius, 265.
  albirostris senegalensis, 251.
  niger, 265.
Textoridæ, 250.
Thalpochares ætheria, 68.
Thamnophis sirtalis, 629.
Thanaos brizo, 29.
  funeralis, 30.
  horatius, 29.
  icelus, 29.
  juvenalis, 29.
  nævius, 29.
  petronius, 29.
  platus, 30.
  somnus, 28.
  terentius, 29.
Thaneroclerus, 206.
  buqueti, 206.
  girodi, 206.
Thaumatopsis floridella, 126.
  pectinifer, 126.
Thecla favonius, 24.
  wittfeldii, 24.
Theoborus theobromæ, 220.
Therina fervidaria, 100.
  fiscellaria, 100.
Thermonectes circumscriptus, 196.
  margineguttatus, 196.
Thespieus macareus, 33.
Thinobius miricornis, 198.
Thinocharis fuscina, 199.
  amithi, 199.
Thinolestes, 843.
Tholeria reversalis, 117.
Thoracophorus guadalupensis, 198.
Thorybes daunus, 28.
Thraupis bonariensis, 587.
Throscidium invisible, 199.
Thymelicus baracoa, 31.

Thymelicus brettus, 31.
  cernes, 31.
  otho, 31.
Thyridopteryx ephemeræformis, 104.
  pallidoventa, 104.
Thyris lugubris, 107.
Thysania zenobia, 79.
Thysanopsis, 231.
  albicauda, 231.
Tiffany beds, 829.
Tilapia, 750.
  acuticeps, 655, 662, **726.**
  andersonii, 726.
  boulengeri, 662, **726.**
  christyi, 656, **726.**
  dolloi, 662, **726.**
  fasciata, 662, **726.**
  lepidura, 659, 662, **726.**
  melanopleura, 657, 658, 660, 662, **726.**
  stigmatogenys, 655.
  stormsii, 662, **727.**
  tholloni, 726.
  williamsii, 662, **727.**
Timetes chiron, 17.
Tinea seminolella, 146.
Tioga aplastella, 128.
Tlascala finitella, 130.
Tolype minta, 86.
Tomarus acutus, 202.
Tomitherium, 843.
  rostratum, 849, 850, 851.
Tornos cinctarius, 96.
  scolopacinaria, 96.
Torosaurus, 281.
Tortrix chioccana, 140.
  ivana, 140.
  peritana, 139.
  seminolana, 140.
Tosale oviplagalis, 123.
Townsend, Charles H. T., second paper on Brazilian Muscoidea collected by Herbert H. Smith, 221–233.
Trachelizus linearis, 218.
Trachyderes succinctus, 210.
Trachyglanis, 750.
Trachyoribates **zeteki,** 159.
Trachyuropoda **longa,** 158.
Trama detrahens, 77.
Trama hinna, 77.
Trematocara, 751.
Tribolium confusum, 214.
  ferrugineum, 214.
Tricentes, 822, 825.
Triceratops, 281.
Trichinochæta, 224.
  orbitalis, 224.
Trichoptilus centetes, 135.
  lobidactylus, 135.
Trichostibas calligera, 141.
  parvula, 141.
Trichotaphe condaliavorella, 142.
  flavocostella, 142.
  melantherella, 142.
Trigonias, 576.
Tripselia fryeri, 559.
Tripudia quadrifera, 69.
Trivolusia roseopennella, 134.
Trochiloleskia, 226.
  flava, 227.
Trogoderma insulare, 202.
Trogolemur, 833, 837.
Trogophloeus aridus, 198.
  smithi, 198.
Tropæa luna var. dictynna, 43.
Tropheus, 750.
Tropisternus chalybeus, 197.
  collaris, 197.
  lateralis, 197.
  ovalis, 197.
Trox suberosus, 208.
Trypetes guildini, 217.
Tryphæa semirufa, 202.
Typophorus viridicyaneus, 211.
Tyrissa multilinea, 69.

UINTASOREX, 833, 837.
Uloma retusa, 214.
Ulophora caricæ, 129.
Ulosomus furo, 217.
  laticaudis, 217.
Ulosonia biimpressa, 214.
Uræginthus, 261, 262, 278.
  bengalus, 278.
Uranotes melinus, 23.
Urobrachya, 261, 262, 263.
Uroloncha, 261, 263.
Utetheisa, 340.

Utetheisa bella, 52.
  bella var. terminalis, 52.
  bella var. venusta, 52.
  elata, 342.
  ornatrix, 51.
  ornatrix bella, 341, 342.
  ornatrix ornatrix, 341, 342.
  ornatrix stretchii, 341, 342.
  ornatrix venusta, 341, 342.
  pulchella, 342.
  semara, 342.

VANESSA atalanta, 15.
  cardui, 15.
  huntera, 15.
Varicorhinus, 748.
Varneria atrifasciella, 133.
Vespertilio bocagii, 439.
  hispida, 425.
  minuta, 445.
  nanus, 441.
  rüppellii, 443.
  vampyrus helvus, 414.
Vespertilionidæ, 414, 486.
Vesperugo (Vesperus) moloneyi, 446.
Vesperus tenuipinnis, 443.
Victorina steneles, 16.
Vidua, 261, 262, 263, 279.
  serena, 250, 256, 257, 279.
Viduinæ, 243, 244, 263.
Viereck, Henry L., new species of bees of the genus *Andrena*, from Equatorial Africa, in the American Museum of Natural History, 235–239; contributions to our knowledge of the bee genus *Perdita*, 241–242.

WALSINGHAMIA diva, 141.
  slossonia, 141.
Watson, Frank E., see Grossbeck, John A.
Wekiva nodosella, 134.
Whydahs, general view of, 256.
Wunderia, 133.
  neæriatella, 133.

XANTHOMELANOPSIS **brasiliensis**, 233.
Xanthopastis timais, 63.
Xanthophilus, 261, 262, 263.
  capensis, 250.
  xanthops, 270.
Xanthoptera nigrofimbria, 68.
  semiflava, 68.
Xanthotype crocataria, 100.
Xenocharax, 748.
Xenochromis, 751.
Xenomystus, 746.
  nigri, 657, 662, 674.
Xenopomatichthys, 747.
Xenotilapia, 751.
Xyleborus affinis, 220.
  ferrugineus, 220.
  grenadensis, 220.
  inermis, 220.
  perforans, 220.
  sacchari, 220.
Xylestia pruniramiella, 146.
Xylocleptes carbonarius, 220.
  limbatus, 220.
Xylographus, 206.
Xylopertha, 207.
Xylophanes chiron nechus, 43.
  pluto, 43.
  porcus, 43.
  porcus continentalis, 43.
  tersa, 43.
Xylophilus (Hylophilus) atomarioides, 215.
  (Hylophilus) halticiodes, 215.

YPOPHÆMYIA malacosomæ **brasiliensis**, 231.

ZALE horrida, 78.
Zanclognatha lituralis, 79.
Zanycteris paleocenus, 569–571, 831.
Zerena cæsonia, 10.
Zonæginthus, 261.
Zophobas morio, 214.
Zuphium americanum, 195.
Zygæna lichas, 343.
Zygosturmia protoparcis **meridionalis**, 231.
Zylomeira torquata, 207.

(Continued from 4th page of cover.)

Part III.— Traditions of the Quinault Indians. By Livingston Farrand, assisted by W. S. Kahnweiler. Pp. 77–132. January, 1902. Price, $1.00.

Part IV.— Shell-Heaps of the Lower Fraser River. By Harlan I. Smith. Pp. 133–192, pll. vi–vii, and 60 text figures. March, 1903. Price, $1.00.

*Part V.— The Lillooet Indians. By James Teit. Pp. 193–300, pll. viii and ix, 40 text figures. 1906. Price, $1.80.

*Part VI.— Archæology of the Gulf of Georgia and Puget Sound. By Harlan I. Smith. Pp. 301–442, pll. x–xii, and 98 text figures. 1907. Price, $3.00.

*Part VII.— The Shuswap. By James Teit. Pp. 443–789, pll. xiii–xiv, and 82 text figures. 1909. Price, $6.00.

Vol. V. Anthropology.

Jesup North Pacific Expedition, Vol. III.

Part I.— Kwakiutl Texts. By Franz Boas and George Hunt. Pp. 1–270. January, 1902. Price, $3.00.

Part II.— Kwakiutl Texts. By Franz Boas and George Hunt. Pp. 271–402. December, 1902. Price, $1.50.

*Part III.— Kwakiutl Texts. By Franz Boas and George Hunt. Pp. 403–532. 1905. Price, $1.40.

Vol. VI. Anthropology.

Hyde Expedition.

The Night Chant, a Navaho Ceremony. By Washington Matthews. Pp. i–xvi, 1–332, pll. i–viii (5 colored), and 19 text figures. May, 1902. Price, $5.00.

Vol. VII. Anthropology (not yet completed).

Jesup North Pacific Expedition, Vol. IV.

Part I.— The Decorative Art of the Amur Tribes. By Berthold Laufer. Pp. 1–79, pll. i–xxxiii, and 24 text figures. December, 1901. Price, $3.00.

Vol. VIII. Anthropology.

**Jesup North Pacific Expedition, Vol. V.*

Part I.— The Haida of Queen Charlotte Islands. By John R. Swanton. Pp. 1–300, pll. i–xxvi, 4 maps, and 31 text figures. Price, $8.00.

Part II.— The Kwakiutl of Vancouver Island. By Franz Boas. Pp. 301–522, pll. xxvii–lii, and 142 text figures. 1909. Price, $10.00.

Vol. IX. Zoölogy and Palæontology.

Part I.— The Osteology of *Camposaurus* Cope. By Barnum Brown. Pp. 1–26, pll. i–v, December, 1905. Price, $2.00.

Part II.— The Phytosauria, with Especial Reference to *Mystriosuchus* and *Rhytiodon*. By J. H. McGregor. Pp. 27–101, pll. vi–xi, and 26 text figures. February, 1906. Price, $2.00.

Part III.— Studies on the Arthrodira. By Louis Hussakof. May, 1906. Pp. 103–154, pll. xii and xiii, and 25 text cuts. Price, $3.00.

Part IV.— The Conard Fissure, A Pleistocene Bone Deposit in Northern Arkansas, with Description of two New Genera and twenty New Species of Mammals. By Barnum Brown. Pp. 155–208, pll. xiv–xxv, and 3 text-figures. 1907. Price, $2.50.

Part V.— Studies on Fossil Fishes (Sharks, Chimæroids, and Arthrodires). By Bashford Dean. Pp. 209–287, pll. xxvi–xli, and 65 text figures. February, 1909. Price, $3.50.

Part VI.— The Carnivora and Insectivora of the Bridge Basin, Middle Eocene. By W. D. Matthew. Pp. 289–567, pll. xlii–lii, and 118 text figures. August, 1909. Price, $5.00.

Vol. X. Anthropology.

**Jesup North Pacific Expedition, Vol. VI.*

Part I.— Religion and Myths of the Koryak. By W. Jochelson. Pp. 1–382, pll. i–xiii, 1 map, and 58 text figures. 1905. Price, $10.00.

Part II.— Material Culture and Social Organization of the Koryak. By W. Jochelson. Pp. 383–811, pll. xiv–xl, and 194 text figures. 1908. Price, $12.00.

Vol. XI. Anthropology.

**Jesup North Pacific Expedition, Vol. VII.*

Part I.— The Chuckchee: Material Culture. By W. Bogoras. Pp. 1–276, pll. i–xxxi, 1 map, and 199 text figures. 1904. Price, $8.00.

Part II.— The Chuckchee: Religion. By W. Bogoras. Pp. 277–536, pll. xxxii–xxxiv, and 101 text figures. 1907. Price, $4.00.

Part III.— The Chuckchee: Social Organization. By W. Bogoras. Pp. 537–733, pl. xxxv, and 1 text figure. 1909. Price, $3.00.

Vol. XII. Anthropology (not yet completed).

**Jesup North Pacific Expedition, Vol. VIII.*

Part I.— Chuckchee Mythology. By Waldemar Bogoras. Pp. 1–197, 1910. Price, $1.25.

(Continued on 2d page of cover.)

PUBLICATIONS

OF

THE AMERICAN MUSEUM OF NATURAL HISTORY

The publications of the American Museum of Natural History consists of the 'Bulletin,' in octavo, of which one volume, consisting of 400 to 800 pages and 25 to 60 plates, with numerous text figures, is published annually; the 'Memoirs,' in quarto, published in parts at irregular intervals; and 'Anthropological Papers,' uniform in size and style with the 'Bulletin.' Also an 'Ethnographical Album,' and the 'American Museum Journal.'

MEMOIRS.

Each Part of the 'Memoirs' forms a separate and complete monograph, usually with numerous plates.

Vol. I. Zoölogy and Palæontology.

Part I.— Republication of Descriptions of Lower Carboniferous Crinoidea from the Hall Collection now in the American Museum of Natural History, with Illustrations of the Original Type Specimens not heretofore Figured. By R. Z. Whitfield. Pp. 1–37, pll. i–iii, and 14 text figures. September 15, 1893. Price, $2.00.

Part II.— Republication of Descriptions of Fossils from the Hall Collection in the American Museum of Natural History, from the report of Progress for 1861 of the Geological Survey of Wisconsin, by James Hall, with Illustrations from the Original Type Specimens not heretofore Figured. By R. P. Whitfield. Pp. 39–74, pll. iv–xii. August 10, 1895. Price, $2.00.

Part III.— The Extinct Rhinoceroses. By Henry Fairfield Osborn. Part I. Pp. 75–164, pll. xii*a*–xx, and 49 text figures. April 22, 1898. Price, $4.20.

Part IV.— A Complete Mosasaur Skeleton. By Henry Fairfield Osborn. Pp. 165–188, pll. xxi–xxiii, and 15 text figures. October 25, 1899.

Part V.— A Skeleton of Diplodocus. By Henry Fairfield Osborn. Pp. 189–214, pll. xxiv–xxviii, and 15 text figures. October 25, 1899. Price of Parts IV and V, issued under one cover, $2.00.

Part VI.— Monograph of the Sesiidæ of America, North of Mexico. By William Beutenmüller. Pp. 215–352, pl. xxix–xxxvi, and 24 text figures. March, 1901. Price, $5.00.

Part VII.— Fossil Mammals of the Tertiary of Northeastern Colorado. By W. D. Matthew. Pp. 353–448, pll. xxxvii–xxxix, and 34 text figures. Price, $2.00.

Part VIII.— The Reptilian Subclasses Diapsida and Synapsida and the Early History of the Diaptosauria. By Henry Fairfield Osborn. Pp. 449–507, pl. xl, and 28 text figures. November, 1903. Price, $2.00.

Vol. II. Anthropology.

Jesup North Pacific Expedition, Vol. I.

Part I.— Facial Paintings of the Indians of Northern British Columbia. By Franz Boas. Pp. 1–24, pll. i–iv. June 16, 1898. Price, $2.00.

Part II.— The Mythology of the Bella Coola Indians. By Franz Boas. Pp. 25–127. pll. vii–xii. November, 1898. Price, $2.00.

Part III.— The Archæology of Lytton. British Columbia. By Harlan I. Smith. Pp. 129–161, pl. xiii, and 117 text figures. May, 1899. Price, $2.00.

Part IV.— The Thompson Indians of British Columbia. By James Teit. Edited by Franz Boas. Pp. 163–392, pll. xiv–xx, and 198 text figures. April, 1900. Price, $5.00.

Part V.— Basketry Designs of the Salish Indians. By Livingston Farrand. Pp. 393–399, pll. xxi–xxiii, and 15 text figures. April, 1900. Price, 75 cts.

Part VI.— Archæology of the Thompson River Region. By Harlan I. Smith. Pp. 401–442, pll. xxiv–xxvi, and 51 text figures. June, 1900. Price, $2.00.

Vol. III. Anthropology.

Part I.— Symbolism of the Huichol Indians. By Carl Lumholtz. Pp. 1–228, pll. i–iv, and 291 text figures. May, 1900. Price, $5.00.

Part II.— The Basketry of the Tlingit. By George T. Emmons. Pp. 229–277, pll. v–xviii, and 73 text figures. July, 1903. Price, $2.00. (Out of print.)

Part III.— Decorative Art of the Huichol Indians. By Carl Lumholtz. Pp. 279–327, pll. xix–xxiii, and 117 text figures. November, 1904. Price, $1.50.

Part IV.— The Chilkat Blanket. By George T. Emmons. With Notes on the Blanket Designs, by Franz Boas. November, 1907. Price, $2.00.

Vol. IV. Anthropology.

Jesup North Pacific Expedition, Vol. II.

5 901 1

Part I.— Traditions of the Chilcotin Indians. By Livingston Farrand. Pp. 1–54, June, 1900. Price, $1.50.

Part II.— Cairns of British Columbia and Washington. By Harlan I. Smith and Gerard Fowke. Pp. 55–75, pll. i–v. January, 1901. Price, $1.00.

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01262 7501